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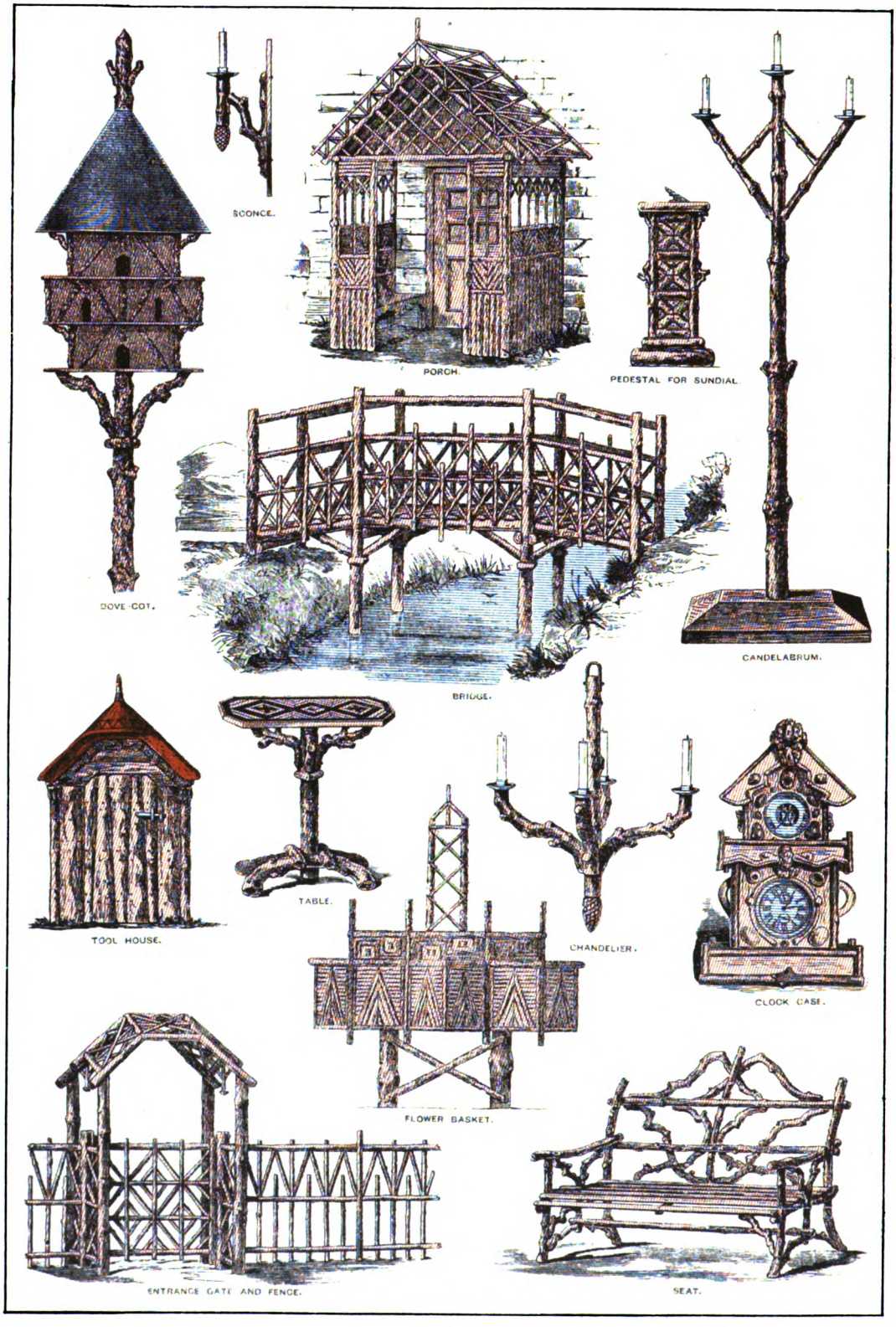

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RECEIPTS, PROCESSES, AND MEMORANDA FOR WORKSHOP USE

BASED ON PERSONAL EXPERIENCE AND EXPERT KNOWLEDGE

PAUL N. HASLUCK
EDITOR-IN-CHIEF

Volume V

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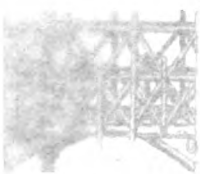

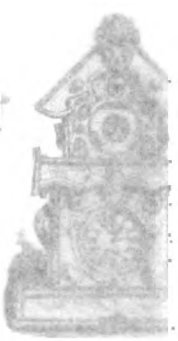

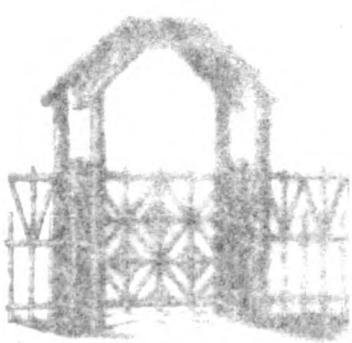

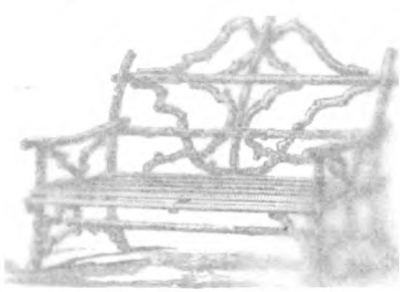

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PREFACE.

CASSELL'S CYCLOPÆDIA OF MECHANICS contains in a form convenient for ready reference and everyday use receipts, processes, and memoranda selected from a rich store of choice information contributed by a staff of skilful and talented technicians, upon whose practical experience and expert knowledge the information is based. The matter contained in these volumes has been carefully digested, freely illustrated, and made plain to those inexperienced.

All compilations of receipts and memoranda for the use of mechanics that have been published—and some have attained great popularity—differ from the present series in the important fact that almost every item in these volumes is the paid contribution of an expert, written specially to satisfy the want of an inquirer, and each has challenged emendation from a wide circle of practical men. Corrective and supplementary matter supplied by these critical readers has been incorporated to ensure the greater efficiency of this work.

A superficial glance through the pages of these volumes might tend to a false impression that the varied contents are not readily available for easy and systematic reference. However, this is not so. Experience has shown that it is not possible to classify paragraphs that often include matters essentially different so that there shall be a definite place for every item, and the impossibility of such a course is particularly emphasised in the present collection, which embraces subjects widely diversified. Even a little consideration of this Cyclopædia would show that no possible arrangement of the paragraphs would place them so that the several facts contained in each could be found with ease and certainty. The copious indexes provide a means by which every separate particular and detail of any kind dealt with in these volumes may be traced and referred to with the least amount of trouble. These indexes also bring together all references to the same subject, however widely they may be scattered, and all varied notes included under one heading are properly analysed and, thus disclosed, regrouped with kindred topics. No pains have been spared in the compilation of this index, which efficiently serves

a purpose impossible to be met by any arrangement of paragraphs comprising the volume.

Amongst the items embodied in this work probably every reader can find some that contain information already known to him. Possibly some readers may be able to supplement the particulars given in respect of matters with which they are familiar. Any authentic supplementary particulars that are likely to be of benefit and that would increase the usefulness of the information will be welcomed, and should be sent to the undersigned.

P. N. HASLUCK.

La Belle Sauvage,
London.

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CASSELL'S

CYCLOPÆDIA OF MECHANICS

CASSELL'S

CYCLOPÆDIA OF MECHANICS.

Æolian Harp.—In the illustrations, Fig. 1 represents a vertical section and Fig. 2 a plan of an Æolian harp. Fig. 3 shows the method of fixing the side to the block. First construct the body of the instrument. For this a piece of sound deal ½ in. thick, 8 ft. long, and 4½ in. wide will be required. This must be planed, and have its edges truly squared. Cut it into two pieces 3 ft. 6 in. long, and two 6 in. long; carefully dovetail the ends of all these pieces to form the sides and ends of a box. For the top and bottom, take a sound piece of ¼-in. or ⅛-in. deal, planed up and glass-papered, 7 ft. long by 6 in. wide, and cut it into two equal pieces 3 ft. 6 in. long. In one piece, which is to form the top or soundboard of the instrument, at 1 ft. from each end, and in the centre longitudinally, cut a hole E (Figs. 1 and 2) about 2 in. in diameter. To strengthen this board for the reception of the pins and screws to which the strings are attached, two blocks will be required. For these take two pieces of beech or other hard wood, 1 in. thick, 5 in. by 4 in. Finish these quite smooth, and attach them to the soundboard on what will be the under side, at ¼ in. from each end and side as shown at B (Fig. 1). They can be fastened with glue and screws from underneath. This board may now be laid on the framework; the blocks, if properly fitted, will just drop in, and in order to withstand the strain to which they will be subjected, may be further strengthened by two small screws on each side passing through the sides of the box into them (see Fig. 3). The top is fastened to the sides and ends by means of glue and small screws fixed round the edges. The other piece of thin board is now to be fastened to the bottom of the box in a similar manner, and the body of the instrument is complete. Seven iron pegs, the same as used for holding the strings in a piano, and a like number of violin pegs will be required. Bore seven holes in each end of the soundboard into the blocks in the position shown at B (Fig. 2); these should be bored in a diagonal direction, as indicated at C (Fig. 1). See that the pegs fit tightly in the holes, the iron pegs at one end, the wooden ones at the other. Now cut two pieces of beech, 5½ in. long by ½ in. by ½ in., and shave off two edges of each to form triangular pieces on a ½-in. base; these must be glued firmly across the face of the soundboard at about 5 in. from each end, and a slight notch made in the top edge opposite to each peg. These will form bridges across which the strings are to be strained. Now get some catgut (violin strings), pass one end through the holes in the iron pegs, carry it over the notches in the bridges, along the face of the soundboard, and attach the other end to the wooden pegs, which turn tightly in their holes until the strings are thoroughly strained. The strings must now be tuned in unison—that is, they must all be of exactly the same

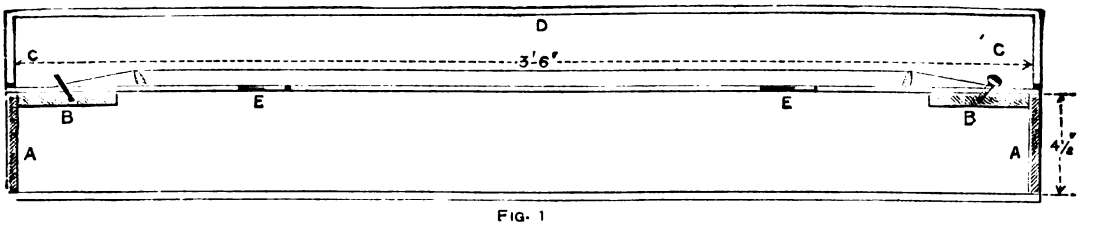


FIG. 1

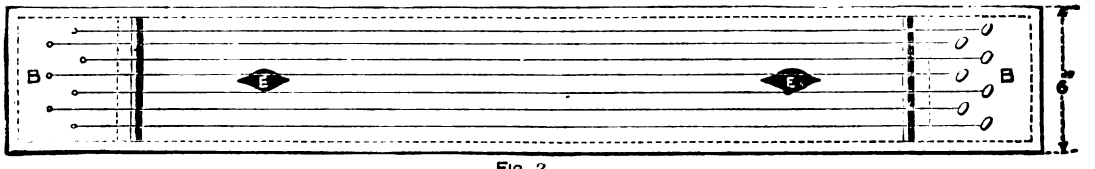


FIG. 2

Æolian Harp.

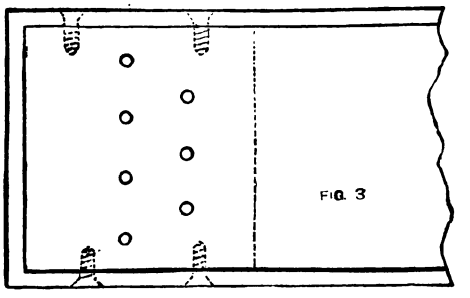
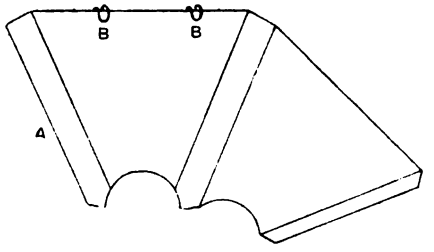


FIG. 3

sound. As the effect is much enhanced by directing the current of wind over the strings, two pieces of ½-in. deal, 6 in. by 3 in., and a piece of board similar in size to that used for the bottom of the instrument, must be glued on one of the small pieces across the edge at each end of the board. This will stand over the face of the instrument as shown in the unhatched portion in Fig. 1. The instrument should be placed on the window-ledge, and the window closed down on top of it at D (Fig. 1).

Mechanical Lantern Slide.—The device here described is novel and original, and is like a "living picture" in holding the interest for some length of time, but it has distinct advantages, for the performance may be prolonged, or even entirely changed, at the will of the operator, while the cost is very small. Prepare a glass cell such as would be used for chemical experiments in the lantern; it should be at least twice as long as an ordinary slide. At the top of this, paint a strip of green ¼in. to ½in. wide, and half the length of the cell. The strip should be uneven, to represent waves, and at one edge should be transparent; but it must gradually darken till it is quite opaque at the top edge of the cell. A little coral island, say, could be painted, and on the other half of the cell a landscape should be depicted. Cut pieces of wood to the shapes of ships, etc., and fit them with masts and rigging of wire sufficiently heavy to cause the ships to float upside-down with the keel above the surface of the water. Sails can be made of tissue paper, varnished to make it waterproof and semi-transparent. Cut a piece of glass to the shape of a balloon with the neck somewhat prolonged, and in waterproof colours paint on this the ropes and car, and to the latter cement a thread or fine wire. Then cut a piece of thin zinc to the shape of the figure illustrated above. When folded at the lines A and soldered up, it will form roughly a cone with the apex cut off. The hooks B will prevent it slipping down when placed in the cell. This cone should now be dented at the narrow sides to make it uneven. Next make some transparent solutions of blue, red, and brown colours, and procure a small squirt. Now for the performance: Fill the cell to the edges of the waves with the blue solution, to produce the sky; then place the cell in the lantern with the seascape showing, and drop two ships in the land half which is out of sight. These may now

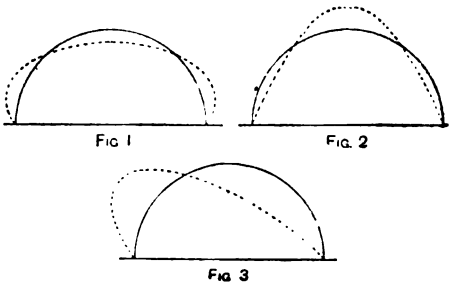


Mechanical Lantern Slide.

be sailed in by touching the keels with wire or a pencil, and if the water is agitated the vessels will rock. Now slowly insert the zinc cone; this represents the rising of a submarine volcano, and by means of the squirt the red and brown solutions are alternately introduced, these being respectively for fire and smoke. A few tiny bits of cork injected with the fire produce the idea of stones shooting out and falling again. As soon as the sky is too thick with smoke, pour it away and fill up again for the landscape half. In this give a balloon ascent, letting this down by means of the wire or thread, which will represent the guide-rope. All sorts of additions will suggest themselves to the operator, such as yacht races, shipwreck, etc.

Gilding and Burnishing Picture Mouldings.—Frames desired with a burnished finish must be water-gilt, as oil gilding does not burnish. Washed or gilder's whiting is used for building up a solid foundation, and is mixed with size made from parchment cuttings, ½ lb. of cuttings making nearly 3 pt. of size. The cuttings are steeped in cold water for about twenty-four hours, then gently simmered for two or three hours, and strained through muslin. When cold it should form a weak jelly. Patent or double size as employed by decorators, or a size made by boiling pale glue, is often used for first coatings. Mix whiting with strong size till of the consistency of paint, and coat the mouldings with this, using it hot: a second coat may be given when the first is dry, if the wood is soft or open grain. Then the surface being smoothed with glass-paper, canvas, or pumice, it is coated with an oil preparation, namely, raw linseed oil, boiled oil, turpentine, and varnish in about equal parts, with sufficient chrome yellow to give a yellow colour. This is also applied like paint, and a second application given when the first is dry. The portions to be finished black must now be treated with a combination of black spirit varnish and French polishing, the parts to be gilded being then coated with parchment size applied with a camel-hair brush. The process of water gilding differs somewhat from oil gilding, but requires a gilder's cushion, knife, tip for lifting the leaf, and a skewing brush to skew or force the leaf into carved or ornamental work. The main difference lies in the fact that the gilding or laying of the leaf may proceed as desired. The surface of the parchment size—as much as can conveniently be handled—is softened with clean water, using a camel-hair brush. Then whilst the surface is still wet, a portion of the gold leaf is cut on the cushion, and by means of the tip is transferred into position, the process of wetting the surface and laying the leaf being repeated till the surface is covered. Take care to let each piece slightly overlap the one previously laid, and as each piece is placed, blow forcibly against it to expel any water that may lie underneath, and press the leaf to the work. A soft brush or tuft of wadding may also assist in pressing the leaf home. It is a practice in some shops to wet the edges slightly where they overlap; others depend on sufficient moisture being pressed from underneath. Experience will soon decide which method is better adapted for the purpose in hand. The burnishing is done by means of an agate burnisher of suitable shape; this is gently but firmly passed along the gold after it has had time to get quite dry. Any idea of burnishing by the aid of machinery is impracticable in the opinion of an expert. Most picture mouldings are imported. Some having an appearance of burnish are worked up cheaply, base metal being used instead of gold, and others are worked up in silver or white metal to which a golden colour is imparted by means of lac solutions; these are generally worked up on a foundation of plaster-of-Paris, instead of whiting and size.

Thrust on Arch.—Below are notes on ascertaining the thrust at the crown of an arch. When an arch is uniformly loaded over the span, the thrust is found by



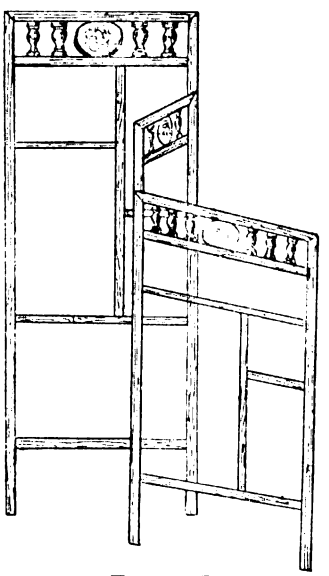
Thrust on Arch.

the same formula as that used for finding the flange stress in a girder uniformly loaded, namely, $S = \frac{W l}{8 d}$, W being the load per foot run, l the span in feet, d the depth of girder or rise of arch in feet, 8 constant, S the stress in the same terms as W, usually tons. The line of thrust in an arch must necessarily pass through the arch somewhere, but the course of the line depends on the nature of the loading. In an ordinary brick segment arch uniformly loaded, the line of thrust is usually within the middle third of the thickness of the arch rings, and in commencing to set off the line of thrust the usual method is to start at the centre of the depth. A tie across the bottom of an arched rib does not affect the course of the line of thrust, which is dependent solely on the distribution of the load, and is even independent of the shape or thickness of the arch. The curve of equilibrium or line of thrust, if inverted, is the shape a chain would take when similar loads were acting at similar points to those on the arch, and this also applies when the loads or forces act in other directions than vertical. Arch ribs under unequal pressure and non-parallel loads are very difficult to work out in order to get the line of thrust just where it is wanted. If the load is concentrated towards the sides, the arch rib and the line of thrust will have the relative positions shown in Fig. 1; and if the load is concentrated towards the centre, the position shown in Fig. 2; while, if concentrated more one side than the other, the relative positions will be as shown in Fig. 3. In order to remember the effect, one may say that the line of thrust bulges out to meet the load.

Estimating Length of Rolled Cloth.—In estimating the length of a piece of cloth that is rolled or blocked on a flat board, the length of the average coil of the material is found to be exactly equal to the longest outside diameter of the entire roll multiplied by 2. To find length, multiply by the number of coils. This should be of great advantage to persons who wish to measure materials so rolled without having to resort to the slow process of undoing the roll and then having to measure the cloth yard by yard.

Preventing Nicotine Escaping from Clay Pipe.—If the fluid products pass through the bowl of a clay pipe, the clay must be very porous; it should only penetrate so slowly as to be burnt into the clay. Dipping the pipe for a few minutes in a solution of silicate of soda might answer the purpose; this will soak into the pores of the clay and fill them up. Another plan is to rub both inside and outside with powdered white French chalk and polish with a rag.

Screen for Holding Photographs.—The accompanying illustration shows a screen on which photographs can be displayed effectively. The screen is made of picture-frame moulding, which could be obtained of any dealer. Old negative glasses are cleaned and immersed one at a time, with a photograph of corresponding size, in a bath of warm gelatine (1 part gelatine in 20 parts water). When thoroughly dry, the paper of the print is rubbed away from the back with sandpaper (No. 0), leaving the picture thin and transparent. The pictures may now be coloured roughly with oil colours from the back, as in the crystoleum process, and when viewed from the front will be effective, always provided,

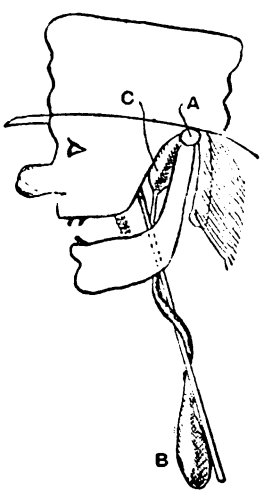


Screen for Holding Photographs.

of course, that the colourist possesses artistic taste. The pictures are then fitted into the frames provided for them, and backed up from behind with white card covered on its outside with black leather paper. If desired, a margin of gold may be put inside the frames either as a slip, or painted on the glass before mounting the photographs. If the worker has not the necessary artistic skill, the pictures may simply be mounted in optical contact in the manner described, and the colouring omitted.

Manufacture of Washing Soda.—The manufacture of soda ash or crude carbonate of soda, and of washing soda or hydrated carbonate of soda, embraces the chief operations of the alkali manufacture, for which a large chemical works with enormous plant is indispensable. As, however, the manufacture is interesting, a short account of it may be given here. The raw material is common salt (sodium chloride), and there are two processes of converting this into carbonate of soda. In the older process, known (after its inventor) as the Leblanc process, the salt is heated with strong sulphuric acid in iron pans, or it is heated in a furnace and sulphuric acid and air passed over it (Hargreaves' process), the result being sulphate of soda or salt cake and hydrochloric acid. The sulphate of soda is mixed in certain proportions with coal slack and limestone, and is charged into a revolving reverberatory furnace, and when the reaction is completed the fused mass is turned out into iron trucks and cooled. The solid blocks are placed in large tanks, where they are treated with water, each lot of water passing through several tanks, so that it becomes practically saturated. The solution of impure carbonate of soda is pumped into a tank placed over a reverberatory furnace, and allowed to flow gradually on to the hearth of the furnace, where the water rapidly evaporates, and the soda ash as it separates is raked to the front till quite dry, when it is raked into barrows. The soda ash is treated with water, allowed to stand, and the clear liquid strained off. It is run into large iron bowls kept in a cold room free from dust; here it evaporates slowly and then suddenly solidifies. Washing soda is a pure hydrated carbonate of soda containing more than half its weight of water of crystallisation. In the newer or ammonia-soda process, a solution of common salt is saturated with ammonia gas, and carbonic acid is pumped in under pressure. A reaction occurs with the formation of carbonate of soda (which separates from the solution), and a solution of ammonium chloride remains. The ammonia is recovered from the latter by heating it with lime or magnesia, and it goes into the process again. This account is a mere outline; all the operations are very intricate, and the final product is obtained only after a large amount of skill and labour has been spent on it.

Pneumatic Ventriloquial Head.—The accompanying illustration shows the working of a pneumatic ventriloquial head. The mouth is worked by a pneumatic arrangement similar to that used in working the shutters of photographic cameras. When the bulb B is pressed,



Pneumatic Ventriloquial Head.

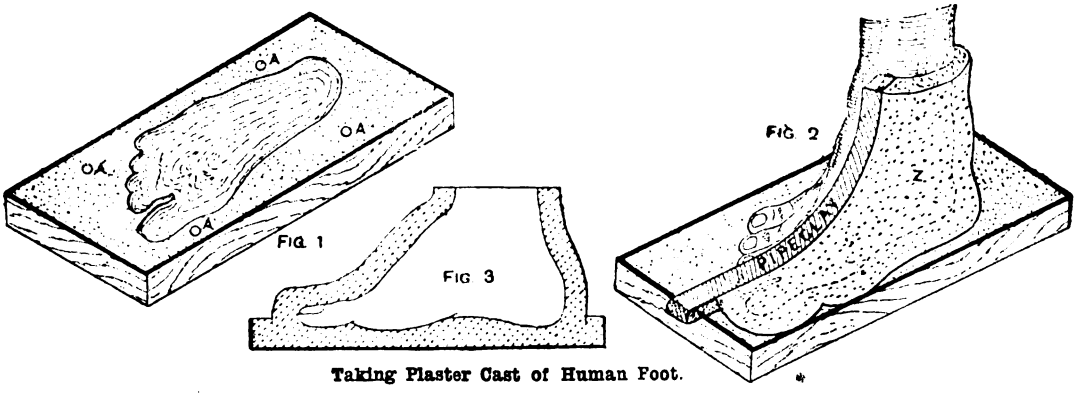
air is forced along the tube into the bulb C, thereby opening the lower jaw, which works on the hinge A. The pin by which the head is turned is held in hand with the rubber bulb. A small spring within the mouth shuts the jaw when the pressure is relaxed.

Repairing Nosings of Stone Steps.—For repairing the broken nosings of stone steps, good Portland cement may be used. It should be coloured with an oxide to the tint of the stone, then mixed up rather stiff and applied with a trowel: a short straightedge or rule should be used to work round the nosing till the shape is satisfactory. The fracture should be washed thoroughly clean with water before the cement is applied. The repaired nosing must be protected from injury for at least a week, and the longer protection can be afforded the better. Although the cement makes a very good job if the work is properly done, the better plan would be to cut the broken piece out of the step (making a neat job) and let in a new piece of the same kind of stone.

Removing Odour of Soft Soap.—Either nitrobenzol (oil of mirbane) or citronella oil would be suitable for scenting soft soap. The former has the odour of almonds, and the latter of lemons. Only a very little of either would be required.

Substitute for Celluloid.—Considered as raw material for celluloid, potatoes contain about 20 per cent. of starch and 80 per cent. of water. By the action of nitric acid on starch it is converted into a nitro derivative, and this nitro derivative is practically the same as nitrocellulose, from which celluloid is made. Hence it is possible to make a celluloid from starch; but, after taking into account the price of the potatoes and the cost of evaporating off the 80 per cent. of water, it will be found that paper or cotton is much cheaper for the manufacture of the nitro-cellulose.

Taking Plaster Cast of Human Foot.—The following are instructions on taking a cast in plaster-of-Paris of the human foot. Procure an oblong wooden box, 12 in. or 13 in. long by about 5½ in. wide (inside measurement), or just large enough to allow the foot to rest in it with about ¾ in. or ¾ in. to spare all round; 1 in. in depth will be ample. Gauge some fine stucco or plaster-of-Paris—sufficient in quantity to fill the box when the foot is resting in it. Pour it into the box, and having brushed over the naked foot some sweet oil, to prevent hair adhering, insert it in the mixture. Level off the superfluous stucco at the top of the box, and when the remainder has set, which should be in a few minutes, withdraw the foot. The result will be the footprint or base section, as shown by Fig. 1. The four small holes A are to form catches for corresponding knobs that will be formed on the two upper parts of the mould. Give the base a coat of shellac varnish to prevent absorption, then rub it over with oil. For the half mould Z (Fig. 2) of the upper part of the foot, gauge up some more thick stucco; cut a strip of soft pipeclay and place it down the foot, letting the clean-cut edge form as near as possible the central line. The foot, being well oiled, should be again inserted into the base mould, and the thick stucco kneaded over half of it, the thickness being kept at about ½ in. A slip of wood may be held along the centre of the heel to act as a butt at the back, in the same way as the clay in the front. These edges may afterwards be squared up with a knife if necessary. When section Z is thoroughly set, remove it and coat it with varnish and oil as before. The other half is taken in a similar manner. The foot is again rested in its base, section Z is placed in its position, and the strip of clay being removed, the remaining portion is moulded to shape. The mould will then be complete, and any number of casts may be taken from it. Fig. 3 shows a section of the mould complete. Fit the three parts together, and tie them round with a piece of string to keep them in position. Gauge sufficient stucco, of about the consistency of thick cream, to fill the mould, pour a little into it and shake it well, so that it may penetrate into and fill up all crevices. Pour in some more and again well shake it, then fill up with the remainder and allow it to set thoroughly hard. When the mould is taken apart, a perfect reproduction of the natural foot should be the result. It may be either varnished or left white, according to taste.



Taking Plaster Cast of Human Foot.

Clarionet Mouthpiece.—The distance in a clarionet between the mouthpiece and the reed must depend on three conditions, namely (1) the stiffness of the reed, (2) the tension of the player's lips, and (3) the amount of available wind for playing. The distance from the tip to the point of contact of the reed with the mouthpiece need only be enough to obtain the lowest note on the clarionet. Now ¾ in. is sufficient, but a longer aperture gives a better tone. There are other considerations, and ¾ in. may be taken as the longest opening permissible, and the lowest note is almost always good with a fair reed. The most important condition is that the curvature of both sides of the mouthpiece is identical. To test this, hold a piece of best plate-glass in contact with the mouthpiece and try a cut strip of writing-paper under it; note the distance to which it can be inserted. It should stand at right angles to the centre line of the bore. A little water on the flat surface of the mouthpiece will show whether the contact of the flat part with the glass plate is true, and whether the springing begins equally on both sides. Several pieces of sheet metal flattened and having edges free from burrs may be tried. These should be of various thicknesses, but all less than ¼ in., which is about the greatest distance an average player will desire. As to the actual curve, it is impossible to dogmatise, but if the reed is placed in position it should, when closed by pressure, close the aperture gradually and completely; this cannot be the case if the curve has any abruptness. Since for even the highest sound there must be some aperture, it may be true, as some assert, that the top ¼ in. may be quite flat, but the rest of the distance must be an "easing curve" to which the flat on which the reed is fixed is a tangent. As the reed is stouter towards the fixed end, it is almost certain that the form of the mouthpiece should be a portion of an ellipse. Many mouthpieces will not bear the test here proposed, but it will be easy with a slip of oilstone or water-of-Ayr stone slightly to rub down the side of the aperture that is the closer, as tested by the thin sheet metal or stiff paper. There is another consideration—that is, the position of the flat, or table, in relation to the grain of the wood. It seems reasonable that a clarionet mouthpiece should have the table parallel to and on the bark side of the timber and not diagonal to it, just as a joiner's trying-plane is made. Reeds should be a full straw colour, not orange, nor lemon with a trace of green, nor dull buff. If a reed is roughened by wetting it, throw it away. Held up to the light, it should show a regular gradation towards a semi-transparent tip. It is better if cut from a cane of about 1 in. in diameter than of a smaller size. It has been found that the tube of a clarionet cannot raise, though it can lower, the pitch of a reed. This was proved by cutting away the whole of the back of a mouthpiece, and it was thereby discovered that the highest tones must be obtained from a fairly stiff reed, and not from one that has lost its elasticity through long use and through the continued moisture to which it is, of course, subject.

Mixing Colours for Coach-painting.—For coach-painter's greens, use coach green, imperial green, permanent green, or the imperial green made by mixing together emerald green and ivory black. A variety of greens may be prepared by mixing together ure prussian blue and lemon chrome. A very deep or dull shade can be obtained by adding ivory black or burnt turkey umber. For blues use ultramarine and prussian blues; the former is used in its pure state, whilst the latter may be tinted or made paler by addin white-lead. For brown, use raw and burnt umber, also vandyke brown. For yellows, pale lemon or middle chrome are used. Tan colour is a mixture of turkey red and burnt sienna, or venetian red and burnt sienna. These must be ground very finely to obtain good results. The above colours are obtained in paste form ground finely in turpentine; they are then thinned down ready for use with 3 parts of turpentine and 1 part of body varnish. The method of thinning or mixing the pigments varies according to the class of work required.

Curing Moleskins.—A quick and most effective method of dressing mole and other small skins to render them soft and supple is as follows. Whilst they are freshly stripped from the trunk, steep them in a strong solution of American potash in water, until the upper skin is removed, care being taken not to leave them too long in the liquid. Then dry them in sawdust, which will absorb the moisture. Finally, neatsfoot oil, with a small addition of camphor or oil of birch, which imparts a pleasant smell, is applied sparingly to effect entire softening. A final application of benzoline and a brisk brushing will remove the surplus oil, and bring out the natural gloss of the fur.

Estimating Wood in Wardrobe.—In measuring up the amount of wood used in making a wardrobe, to find its exact cost, the various items should be treated in order, and entered on a sheet of paper ruled as below, making due allowances for working. All pieces of the same thickness should be taken first, the items of each

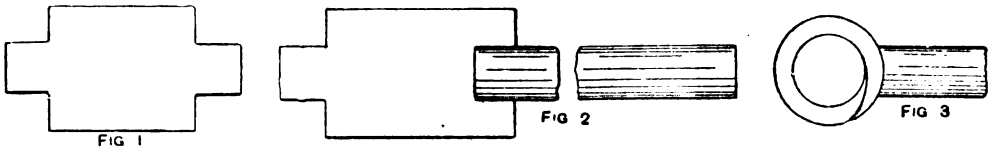
	No.	Width.	Length.	Thick.	Totals.	Reduced Foot Run.
		in.	ft. in.	in.		
St.	4	3	6 0	1	1 ft. by 6 ft. by 1 in.	
R.	4	3	1 10	1	1 ft. by 1 ft. 10 in. by 1 in.	
	2	11	6 6	1	1 ft. 10 in. by 6 ft. 6 in. by 1 in.	Yellow.
					3 ft. 10 in. by 14 ft. 4 in. by 1 in. = 54 ft. 11 in. super. =	73 ft. 3 in. by 9 in. by 1 in.
	2	11½	5 8	0¾	1 ft. 11 in. by 5 ft. 8 in. by ¾ in.	
	6	5	4 0	0¾	2 ft. 6 in. by 4 ft. by ¾ in.	Pine.
					4 ft. 5 in. by 9 ft. 8 in. by ¾ in. = 42 ft. 8 in. super. =	46 ft. 6 in. by 11 in. by ¾ in.

length being totalled, and the several totals added to find the sum. The dimensions are then multiplied together to find the superficial content in square feet, and then reduced to running feet either 9 in. or 11 in. wide. Yellow and white deal are reduced to 9 in., and pine and basswood to 11 in., as these woods are always sold by the foot run of those widths; mahogany and other hardwoods need not be reduced, as they are sold by the foot super. as 1 in. thick. For doors, measure from edge to edge plus ¾ in. for the length of the rails; allow 1½ in. on stiles, and ¾ in. on finished widths for waste. For panels, measure the neat length and width between the inside edges plus 1 in., and for the carcase take the total height net, but on the width allow ¾ in. extra. Allow ¾ in. on drawer fronts and backs, and take the net depth of drawer plus ¾ in. on the width. For the bottoms, measure from outside to outside. All mouldings, fillets, bearers, etc., are estimated by the foot run by the greatest dimensions, plus the width for each mitre. To ensure that no part has been overlooked, initial each item, as R for rail, St for stiles, etc. To reduce superficial feet to foot run of 9 in., multiply by 12 and divide by 9; to reduce to 11 in., divide by 11.

Annealing German Silver.—German silver and similar alloys are annealed by the application of heat regularly and equally during manipulation. It may be done over a brazier's gas hearth. Another plan is to use an ordinary annealing oven. Articles placed in the oven would be regularly heated, and when cooled may be worked again as necessary.

Stove Enamelling Cycles.—For stove enamelling cycles, prepare the work by well cleaning with emery cloth, dust thoroughly, and then wipe over with a cloth soaked in turpentine. Give a coat of first coating enamel, then stove for three-quarters of an hour at 300° F. to 350° F. Rub down with powdered pumice and water, using a piece of alpaca for the purpose, then wipe over with a rag, followed by a perfectly clean rag free from fluff or loose pieces. Coat with Mander Bros.' finishing enamel, and stove at 380° F. for an hour. This should be sufficient for repairs or cheap work. For best work, repeat the rubbing down with pumice, etc. Give another coat of finishing enamel, and stove as for the second coat. The work must now be hand polished with black rottenstone and water; this requires great skill and practice, and generally results in a dull finish when attempted by an amateur. It is not necessary to varnish the black work, but coloured enamels are sometimes varnished after the last coat, and stoved for half an hour or so. The plated parts cannot be prevented from getting discoloured in the stove, but they soon polish up again after enamelling. To enamel successfully, first see that everything (brushes, enamel, stove, enamelling room, and bench) is clean, and that the worker's clothes are free from dust. Sprinkle the floor with water before starting, and dust the inside of the stove, rods, and hooks frequently. Flat brushes about 1½ in. wide should be used.

Forging Backband Hooks for Shafts.—The simplest way of making iron backband hooks for shafts is as follows. Take a piece of 2-in. or 2½-in. by ⅝-in. iron, calculate the length required to form the eye, and cut it to Fig. 1, scarfing down the ends. Get a piece of ¾-in. or ⅞-in. round iron, thicken the end by jumping up, and weld it to the flat iron as shown by Fig. 2. Then bend



Forging Backband Hooks for Shafts.

the flat part over the bick iron, drive in a drift of the desired size, and with a set hammer work the ends of the flat piece round the drift until it forms the eye as shown by Fig. 3. Now take a heat, weld in the scarfs on the shank, drive in the drift, weld the scarf on top of the eye, clean up, and cut off to length.

Stability of Foundations.—The question of the stability of the foundations of buildings, etc., proves a complex one. The under surface of the structure producing the pressure on the foundations may be apparently acting uniformly, because the weight above may be uniformly distributed; but as the material supporting the weight can escape more readily at the sides than in the centre, there is reason to suppose that the pressure will not be uniform. Taking the average pressure as p, the maximum in the centre will be about $1{\cdot}6\,p$, and the minimum round the sides about $0{\cdot}8\,p$. The average pressure is what is usually calculated and allowed for. Rankine's formula is based on the natural slope or angle of repose of the various soils, as their supporting power will vary with their tendency to slip away from the pressure, and bulge up outside. For example, in the formula, $P = w\,x\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$, P = maximum vertical pressure in pounds per square foot, x = depth below surrounding surface in feet, w = weight per cubic foot of earth in pounds, ϕ = angle of repose of earth, safe load = ½ P. Take the case of a heavy ballast, say w = 120 lb., x = 4 ft., $\phi = 45°$, then P = 7·27 tons, and the safe load = say 2½ tons per square foot. The great difference produced by the variation in the angle of repose, or, in other words, the firmness of the soil, is shown by the change in value of the expression $\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$, which for ϕ 15° = 2·89, 30° = 9·00, 45° = 33·94, 60° = 193·8. An approximate formula is as follows. $P = \frac{\phi^2}{4000} \times d$, where P = the safe load in tons per square foot on the base of the foundation, d = depth in feet below the surface immediately surrounding, ϕ = angle of repose or natural slope of the earth in degrees. The formulæ are applicable within all ordinary limits.

Stoving or Japanning Tin Trunks, Cans, etc.—The paints used for stoving such goods are of the best and purest quality, ground to a paste in oil. They are thinned down with turpentine, and a small quantity of japanners' gold-size is added to bind them. The articles are then painted in the desired colours, subjected to a slight heat until thoroughly hard and dry, and then varnished with japanners' hard copal varnish, placed in a stove, and subjected to a temperature of about 240° F. for from one to two hours until they have the desired finish, the time required depending on the quality of varnish employed. For a white paint, use zinc white or white-lead; for green, use Brunswick or chrome greens; for chocolate, use 7 parts of Indian red and 1 part of black. The quantity of each for 7 lb. of paint will be:—Pure paste paint 5½ lb., turpentine about ¾ pt., and japanners' gold-size ¼ pt. Best paint will stand hot water for a limited time, but will not resist the action of boiling water, especially where any soap or alkali is present.

Wooden Tailstock for Lathe.—A wooden tailstock for a lathe is shown by Figs. 1, 2, and 3. The body part is in two pieces; beech or birch or similar hard wood will be suitable. The centre may be formed of a bolt with a

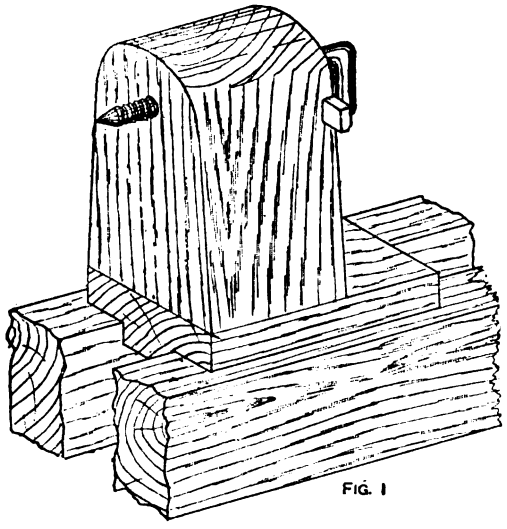


FIG. 1

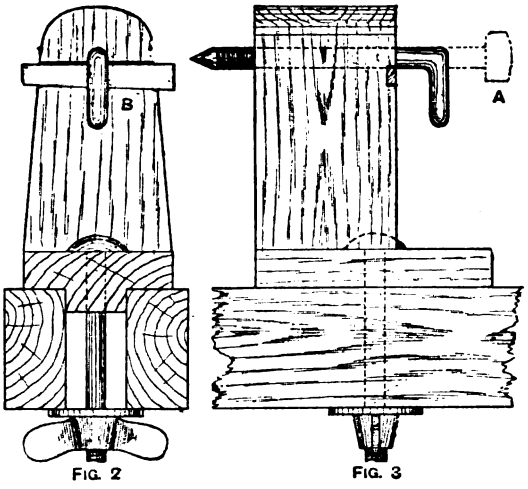


FIG. 2 FIG. 3

Wooden Tailstock for Lathe.

wooden thread made conical as shown. It may be used with the head as indicated by the dotted lines A (Fig. 3), but as it would require a spanner for turning, the better plan would be to get a smith to turn down the end of the bolt as illustrated. If care is taken in boring a hole and the screw is made to fit fairly tight, it will not become loose by the revolving of the work; but a simple contrivance to obviate this is to cut a slot in the back of the vertical piece as shown at B (Fig. 2), so that a metal wedge can fit in the slot and up against the bolt. This can be tightened or loosened by a tap with the hammer.

Coating Cycle with Aluminium Paint.—Previous to applying the paint the machine should be thoroughly cleaned, all the old enamel scraped or burnt off, and the metal well rubbed down with emery cloth. Two coats of paint should be given, the first coat being rubbed down smooth with powdered pumice and water and thoroughly dried and dusted before applying the second coat. It will add to the durability and appearance of the job if a coat of pale oak varnish be given. To apply the paint, use a flat soft badger or camel-hair brush. Do the work in a warm room free from dust and draughts, and if an enamelling stove is available, stove each coat at about 240° F. for half an hour or so.

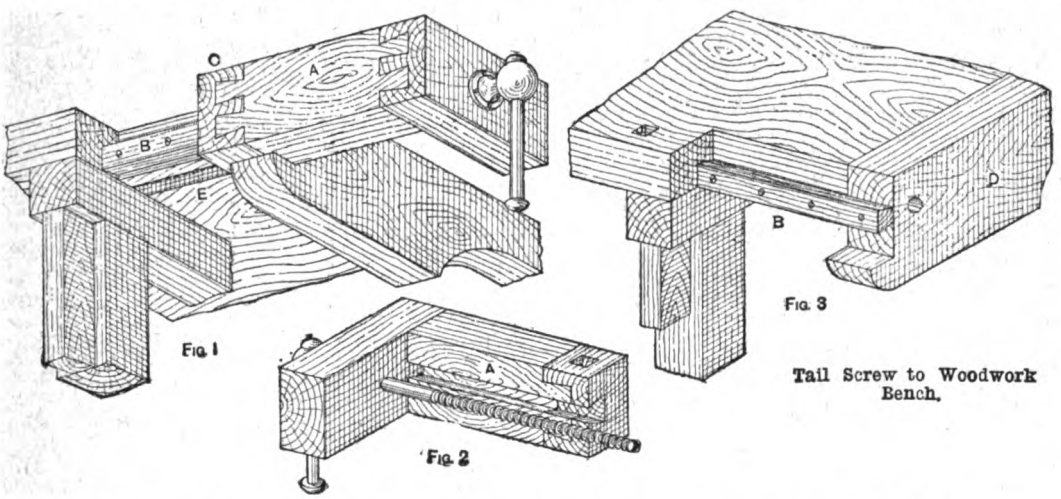
Copying Faded Photograph.—A copy of a photograph may be even better than the original, and may possibly show more detail; but any parts of the picture that have entirely disappeared cannot be restored. The method described below will in most cases give fairly good results. Fasten the copy to the board in a good full light. A blue light or a light rich in violet rays, such as an electric arc light, or even burning magnesium ribbon, is preferable to daylight. In the dark slide place first a sheet of glass coated with gelatine stained faintly with methyl blue, and immediately on this blue glass place (rough side towards the iens) the ground glass. An old unused photographic plate with the silver fixed out can be used, after dyeing, for the blue glass. With the glasses in this position (keep the glasses in place by rubber bands or other simple contrivance) place the slide in the camera grooves, draw both shutters, and focus the picture. The ground glass is then removed, and its place in the slide is taken by a sensitive plate, the blue glass being kept in front as before. This work is done in the dark room. The blue glass is placed in front of the sensitive plate for the purpose of absorbing the yellow light, because all the rays of light used in forming the image on the sensitive plate must pass through the blue glass before reaching the plate. The photographic plate is much less sensitive to yellow than to any other light, and consequently those parts of the picture that are yellow are represented in the negative by more or less transparent patches that ultimately print black. Now if those portions of the picture that ought to be white have become yellow, and eventually show black in the print, such a picture must look flat, being without contrast, and the mind receives the impression of little more than form only. By introducing the blue glass the yellow rays are filtered out, and contrast is to a large extent restored. A process plate (that is, a plate specially made for giving extreme contrasts) should generally be employed, and if care is exercised the best possible results will be obtained. The following method of restoring the original photograph has been suggested, but cannot be recommended. Tungstate of soda 10 gr., distilled water 500 c.c.; carbonate of lime 1 gr., chloride of lime ·25 gr., chloride of gold 1 gr., distilled water 10 c.c. Allow the lime, etc., solution to stand for twenty-four hours, then filter and mix with the soda solution. Well wash the prints and place them in this bath for ten minutes; when the prints have assumed a purple colour, transfer to tungstate of soda ·5 gr., hyposulphite of soda 1 gr., water 25 c.c., and wash.

Tying Lashings to Poles.—Assuming that two 6-in. poles are to be connected at the head to make a pair of shear legs, get a piece of 2-in. rope about 30 ft. long. After laying the poles down on the ground at the proper angle, the rope should be tightly bound (by taking a couple of turns) round the joint, and the loose end then passed over the top between the poles so that the subsequent coils hold the end firmly. Then continue the binding for say half-a-dozen turns before passing the rope over and under in the other direction; continue this for at least four turns, and then pass the end through the part that first turned over and under. A wedge may then be driven between the rope and the poles in such a manner that the thick end of the wedge is upwards when the poles are raised. Two short ropes of 20 ft. each may, if desired, be used instead of the one long rope. The operation is rather difficult to describe, and the worker should endeavour to examine some lashings. The end of a rope is kept from fraying by serving it with twine. Twine is also used for tying a loose end in place where the thickness of the rope is too great to hold the end by reeving through a previous turn.

Tempering Steel Paper-cutters.—If made of cast steel, heat the cutters to a blood-red heat, cool out in water that has just got the chill off, rub them up bright with sandstone, then let them down on a piece of hot iron to a deep purple at the cutting edge. When let down to the desired colour, dip them in oil or rub some tallow over them, and lay them on one side to cool. If the cutters are made of double shear steel, treat them as described above, but only let them down to a medium straw colour. If they are too hard, try cooling them in oil and then flaring down; but to be successful by this method requires practice.

Shoemakers' Brown Wax.—To make brown wax as used by shoemakers boil together till thoroughly amalgamated equal quantities of pitch and resin; then pour in some boiled linseed oil (cold, of course), and mix well. Try a small quantity in cold water; if of the proper stiffness, pour it all in, and pull well hand over hand till it floats. Cut in lumps. The quantity of oil used varies according to the season and weather.

Tail Screw to Woodwork Bench.—The conventional views herewith show one form of tail vice for woodwork bench where the side cheek A (Figs. 1 and 2) has a dovetail groove sliding on the dovetail runner B (Figs. 1 and 3). The end and side cheeks are lap-dovetailed



Tail Screw to Woodwork Bench.

together, and also the return piece C. The end piece D forms a clamp to the end of the top, and is secured to it by dowelling. The box or nut for the screw is secured to the back of this piece, and when the top is from 2½ in. to 3 in. thick a chase has to be made on the under side of it for the screw, as shown at E (Fig. 1).

Cord used in Bookbinding.—Ordinary parcel twine is used by bookbinders for sewing books on. Select a 3-ply variety that could also be easily opened out and scraped with a knife. When lacing the boards to the book the cord is pasted and scraped out with a knife, so that after being laced into the board it will hammer down flat and leave no unsightly marks. The cord must be thin enough to lie flat within the saw grooves in the back of the book.

Polishing Ivory Tusk.—There are many ways of polishing ivory tusks, both with the bark or outside skin left on or cut through to the white ivory, by simple polishing as with spirit varnish, and elaborate polishing by abrasion and friction. The process may be simplified by the use of a polishing lathe; in its absence hand work must be resorted to. (*a*) Well scrub the tusk with a hard brush, using hot water in which a little washing soda has been placed, and soft soap, rinsing well with clean water; dry before a fire or in the sun, and give two coats of transparent spirit varnish, letting the first coat dry off well before applying the second. (*b*) To polish with the bark left on the tusk, clean up as for (*a*) and rub well with No. 2½ emery cloth, following with No. 1½, finishing with the finest emery cloth, rubbing always lengthways of the tusk. Next procure some pieces of old blanketing or thick cloth and some ordinary whiting; mix the latter to a thick paste and begin the polishing wet. Let the rubbing pads be well soaked in water, and constantly add fresh whiting to the pad and rub vigorously. When all scratches have disappeared, continue the rubbing with dry pads and whiting. (*c*) To polish a tusk with the outer skin removed, with a smooth half-round file draw-file the tusk till the white ivory appears, using the flat or round side of the file, as the curve of the tusk will allow. This should be followed by scraping, which must be done with quick firm strokes, or the surface of the ivory will become rippled, causing the file to be brought into use again, and destroying the symmetry of the curve of the tusk; a cabinet-maker's well-sharpened scraper will do the work well. After scraping, finish with wet whiting as described for process (*b*), followed by dry whiting. (*d*) Lathe-polishing of ivory is done with revolving brushes, fed with wet whiting, and the final polish is given with a linen dolly fed with dry whiting.

Sweet Making.—The utensils required for making chocolates and other sweets are a clean copper pan, a small furnace or a ring gas burner, stirring spoons, a marble or bright iron slab, a roller, and shears. The raw materials are ordinary white sugar, brown sugar, glucose, tartaric acid or cream of tartar, flavouring essences, colouring matters, and, for toffy, butter. For boiled sweets, place in the pan a weighed quantity of the sugar and just cover it with water; place the pan on the fire and allow the contents to boil, continually stirring to prevent the mass burning or boiling over. At an early stage a pinch of tartaric acid or cream of tartar must be added. Continue the boiling until a little of the sugar, taken out on a clay-pipe stem and dipped in cold water, is hard and brittle, then pour the mass on the slab, roll it out, cut it into strips with a knife, and, when moderately hard, cut up with the shears; by using these diagonally, diamond-shaped sweets are obtained. For acid and lemon drops, use more tartaric acid, with the addition, for lemon drops, of a very little essence of lemon just before pouring; for pear drops, use amyl acetate, etc. Colouring matters are added in minute quantity at starting; suitable harmless colours are sold by confectioners' sundrymen. For chocolates, a warm mortar and pestle and a warm slab are used. Mix together in the mortar to the consistency of a uniform paste, 1 lb. of good cocoa and 6 oz. of powdered sugar; roll this out on the warm slab, make up again in the mortar, and take out portions with a spoon. Form neat drops on white paper laid on trays, and place in a cool place to set. In making bars and fancy designs the chocolate paste is ladled into tinplate moulds, the paste being shaken down by tapping the moulds, and then allowed to set. The making of chocolate creams and fancy chocolates of course requires experience and skill. (See also Series II., p. 135.)

Applying Gold Paint to Wood.—In applying gold paint to wood, much depends upon the medium used in the preparation of the gold paint. A simple method is to rub the surface down with No. 0 glasspaper, dust well, then give a coat of chrome paint made by mixing middle chrome paste paint to a proper consistency with boiled oil 4 parts, oak varnish 2 parts, turpentine 1 part. This paint should be applied thinly and evenly and allowed to dry hard. Should any brush marks appear, rub lightly with No. 0 glasspaper, dust well, then apply the gold paint with a camel-hair or sable brush. The chrome paint forms an excellent ground for the subsequent coats of gold paint.

Rectifying Heavy Touch of Piano.—If the heavy touch is more apparent in the centre of a piano keyboard, it probably is due to a slight twist of the hammer rail or key frame, thus bringing the keys and action mechanism into closer contact. If the keys are furnished with regulating screws under small pieces of cloth glued at the extreme end under the action, or are fitted with capstan regulating studs, try the effect of reducing the friction by turning down the screws or studs; remove the action and burnish the parts that come in contact, using blacklead and a burnisher.

Firewood-splitting Machine.—Figs. 1 and 2 show side and front views of a firewood-splitting machine that has been calculated to split 10 cwt. or slightly more of wood per hour. It is assumed that a wooden construction is desired, and that second-hand iron fittings are to be used. No sizes are given, but the general proportions shown in the drawings should be observed. In Fig. 2 the wheelwork and connections of the feed arrangement (except the eccentric rods) are omitted for the sake of clearness. In Fig. 1 the feed arrangement is indicated by dotted lines only, but an automatic feeding arrangement is essential in the completed machine. The feed is, of course, intermittent, the block standing still while

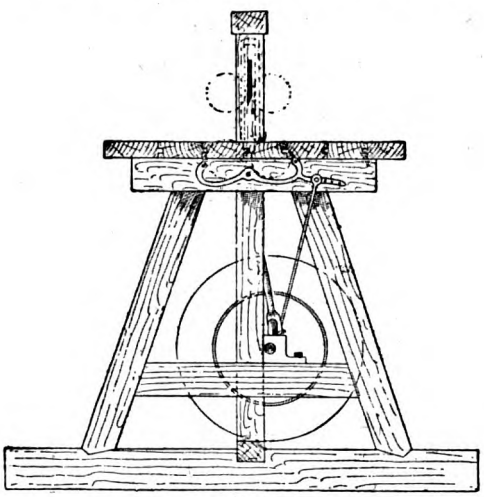


Fig 1

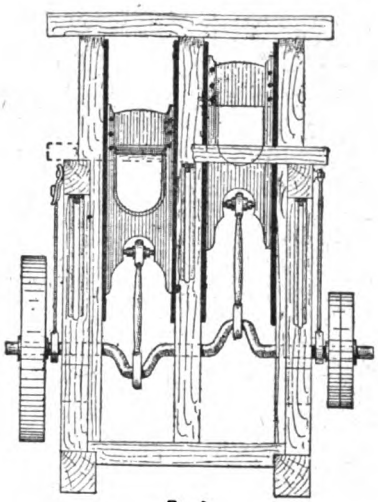


Fig. 2

Firewood-splitting Machine.

the knife is descending. The blocks are passed forward through one of the openings and cut into slabs; they are returned through the other opening and split into sticks. The crankshaft is placed so that the shock occurs while the connecting rod is straight. The various castings (if the construction is to be a new one) could be obtained from almost any sawmill machinery maker, and are nearly similar in pattern to those used in double-deal frames. A disused saw frame, too much worn for accurate sawing work, would do admirably for a firewood-splitting machine, the feed shafting, pulleys, etc., being nearly identical in each case, a small adaptation as to the working bench and knife being all that would be necessary. Most sawmills have one such lying about that might be purchased cheaply. The machine would be power driven, of course.

Dyeing Wool Chestnut Colour.—For dyeing wool chestnut colour dissolve 2½ lb. of acid brown in 4 gal. of water; in this place the wool and bring gradually to the boil; then wring out and pass through cold water, and again wring and dry. Before dyeing the whole of the wool, try a small sample to see whether the shade is satisfactory.

Painting Engine.—Before painting an engine, rub the greasy parts with benzine to remove all traces of grease. Should any of the parts be blistered, apply over the paint a solution made by dissolving ¼ lb. of caustic soda in 1 pt. of water, and allow it to stand until the paint softens, when it may easily be removed and well washed down before painting. The paints to be used should be mixed with oak varnish and gold size, 4 parts of the former to 1 part of the latter, with a small quantity of turpentine added. Colours ground in turpentine may also be used, adding a small quantity of japan gold size as a binder. The engine should be given one or two coats and then finished off with a coat of hard durable copal varnish. All paints should be carefully strained previous to using, otherwise the work may have an irregular or gritty appearance.

Substitute for Sea Salt.—Sea water has been found to contain the following salts in every 100 parts. Sodium chloride (common salt) 2·64, potassium chloride ·075, magnesium chloride ·315, magnesium sulphate ·2, calcium sulphate ·13, and traces of other salts which need not be included. To make up such salt, all the materials must be in a fine powder, and they should be intimately mixed, otherwise the material will be variable. The quantities are common salt 26½ lb., potassium chloride ¼ lb., magnesium chloride 3 lb. 2½ oz., magnesium sulphate 3 oz., and calcium sulphate 2 oz.

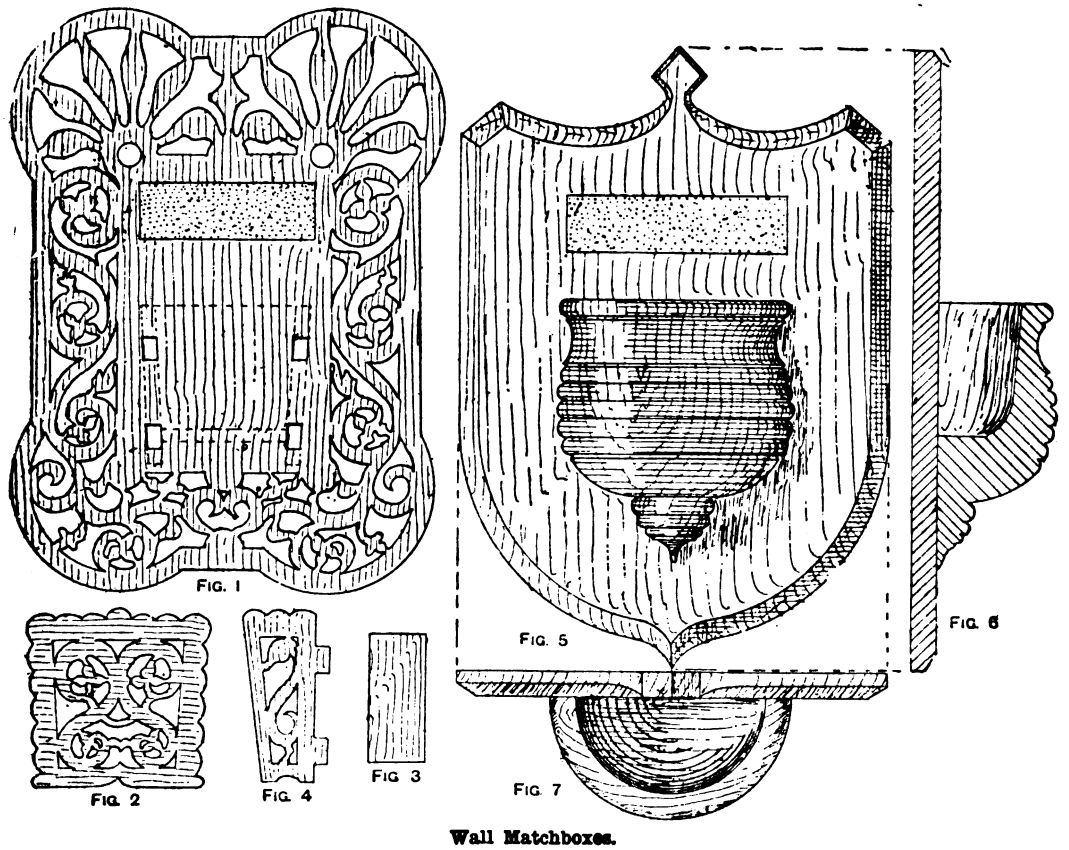
Repairing Bronze Figure.—To mend a broken bronze figure satisfactorily, place a small quantity of solder on the face of the broken parts, hold the two together and heat from (preferably) a Bunsen burner. When the solder runs, press the two parts together and hold them firm till set. The mark may then be covered over with bronze solution (ready mixed) in which a little black is mixed till the right shade is obtained. A very fine camel-hair pencil should be used for applying the solution. If the article has been well soldered there should be but the slightest mark showing the joint.

Steamer for Saucepan.—If a steamer is to be made to fit a saucepan, it is usual to bend a length of wire round to the same shape as the saucepan, and fit this wire a little loosely to the rim of the saucepan cover. The wire is then straightened out and used as the length for the steamer body, and also used for wiring it. If a saucepan is made to fit a steamer, the wire is bent and fitted to the steamer rim, and then used for the saucepan body length as described above. The usual depth for a steamer body is about 6 in., but this, of course, varies according to conditions.

Lubricating Oils.—The chief lubricating oils used for machinery, etc., are petroleum oils of high flash point, and vegetable oils such as rape, castor, olive, etc. In preparing such oils the principal thing to take into account is the kind of machinery for which they are to be used. For very light machinery and high velocities very fluid oils, such as mineral oils, are employed, either alone or in mixture with olive oil. For medium class machinery, rape or castor oil, or heavy petroleums, are used, and for very heavy machinery, fats such as tallow, and greases made from tallow or resin oil mixed with lime, also palm oil, etc. As petroleums are usually very fluid they are often mixed with "blown" oils—that is, castor, rape, or cotton-seed oils which have been artificially thickened by blowing air through them during heating. Some particulars of mineral lubricating oils are given in Series I., p. 319.

Use of Woodworker's Plough.—The plough is a very necessary tool in the construction of any framed work, such as bookcases and wardrobes; it is also essential in making joints, which, without its aid, must generally be made with nails, a very unsatisfactory method when the work is to be polished. An efficient substitute for a plough in many operations would be a ½-in. grooving plane; this might be utilised for tongued joints (although the tongue would be relatively too large), grooving for panels, working rebates, sinkings, etc.

Wall Matchboxes.—The fretwork matchbox illustrated by Figs. 1, 2, 3, and 4 is made of white hard wood ⅛ in. or ¼ in. thick, the back (Fig. 1) measuring 6in. by 4½ in. outside. The holes to take the side pieces of the pocket should be sawn out as shown, Fig. 2 illustrating the front of the pocket, Fig. 3 the bottom, and Fig. 4 the side pieces. A small piece of emery cloth or glass cloth is glued above the pocket, as shown at Figs. 1 and 5, for striking the matches. In the simpler design (Fig. 5), the shield or back piece may be of some dark wood, and the pocket or cup turned of a lighter hued material. Walnut or teak for the shield, and holly or sycamore for the pocket, are very suitable, and look well. Of course, two pockets will be made from one turning, as shown by the section, Fig. 6. The shield is 6½ in. long by 4½ in. wide, and the edges are bevelled as shown in Figs. 5 and 6.



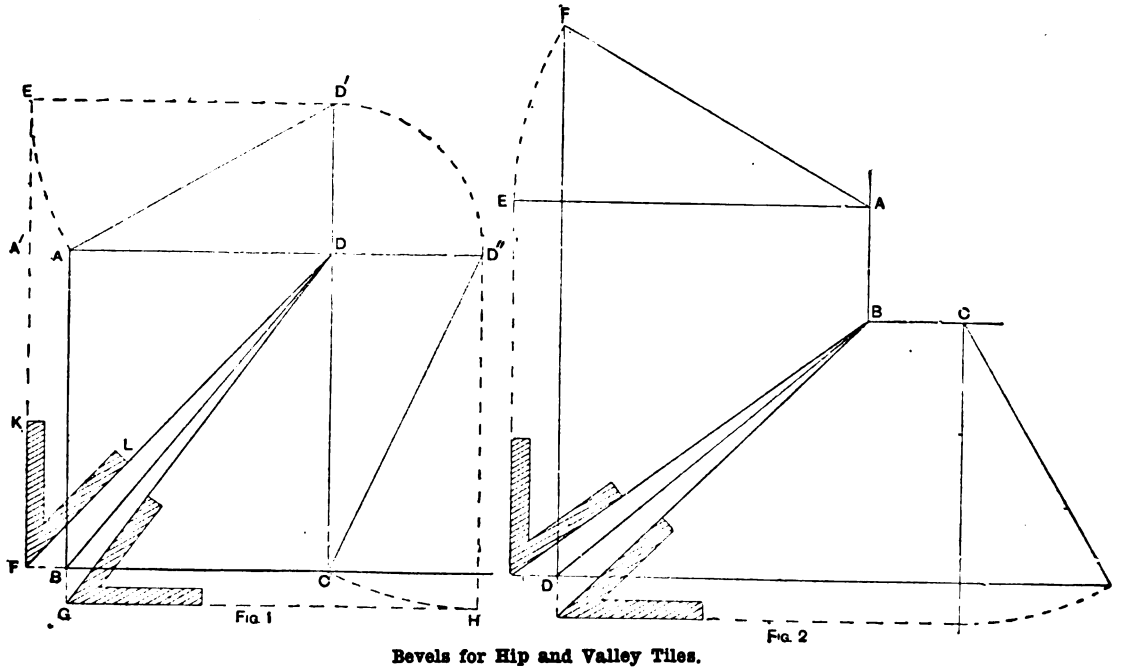
Wall Matchboxes.

Fixing Dado Framing.—The following gives some idea as to the best way of fixing a dado framing 4 ft. high, with batten panelling and planted mouldings, the latter finishing flush with, and mitreing to, the architraves of the windows, etc., all the grounds being fixed. The door and window linings, forming part of the architraves, may be looked on as the vertical boundaries of the design, and should be fixed first, in the usual way, to firrings or grounds, care being taken to keep the face edges plumb and at the required projection as found by applying a piece of the architrave to the ground. Having fixed all these, take on a rod the clear length between the adjacent linings and between linings and return walls, and set out the panelling upon a wide board or upon a clean floor. Nail a fillet down, each line representing the linings, keeping them parallel with the length rod. Next cut the plinth between these fillets very tightly, and mitre in the architraves; cut these off long enough to make the mitres around the openings afterwards. Next line off the top edges of the frieze rail and the dado rail parallel with, and at the required height above, the plinth; mitre these into the architrave. Take the sizes of the panelling and cut the battens off to size, hand tight; remove the mouldings and insert these in place; return the mouldings and clean off. Having finished all the bays in this manner, commence fixing; level and scribe down the plinth if required, fix the fillet at the back, and preferably make a groove ¼ in. deep to receive the skirting fillet. Fix the plinth by nailing near the top edge into the ground backings; offer up the architraves and mitre them around the openings. Fix them by bradding at back and front in the sinkings, insert the lower panels in the rebates, and spring in the frieze moulding on their face; the latter may be bradded, or screwed in pelleted holes; afterwards insert the top panels and fit in the dado rail. Every third or fourth board should be nailed to the grounds, the others left loose to swell and shrink. The backs of all should be painted. Finally, fit the skirting slips into the grooves tightly, and brad the top edges to the plinth.

Tar Varnish for Galvanised Iron.—The following preparation may be used for preserving galvanised iron, and is easily and cheaply made. Melt together in a suitable iron vessel over the fire 7 lb. of coal-tar pitch and 1 lb. of coal tar; slowly add ¼ lb. of quicklime, after which the temperature should be raised and the contents well stirred; this removes all traces of free acids. Now add 1 lb. of lampblack and ½ gal. of boiled oil, stir well and allow to cool down, then remove well away from the fire, and add cautiously 3½ gal. of coal-tar naphtha. After being allowed to get cold the preparation is ready for use. This varnish dries hard in about four hours with an excellent gloss. It is necessary that no light or fire be near when adding the naphtha, as it gives off a vapour which is highly inflammable and travels speedily along the ground.

Treating Oak to Imitate Bog Oak.—The following are instructions on giving to ordinary oak the appearance of bog oak. (1) If the articles are small, suspend them for a few hours in a pickle made of freshly slaked lime and common washing soda, 2 lb. of soda to 1 gal. of limewash. If it is more convenient to apply the liquid with a brush, a common fibre brush will be most suitable. Swill off with plenty of clean water, and, when the articles are dry, brush over with common vinegar before applying any varnish or polish. (2) Vandyke brown mixed into a thin paste with liquid ammonia and thinned out with rainwater. (3) Two ounces of bichromate of potash dissolved in 1 pt. of hot water. The above will give shades of dark brown merging to blackness. For a black colour an ebony stain is advised. Experiment on odd pieces of wood similar to that to be treated till the desired tone is obtained.

Bevels for Hip and Valley Tiles.—A geometrical method of obtaining the bevels for cutting tiles to hips and valleys is shown in the accompanying illustration, and it will be found correct for any plan or pitch. Let A B C (Fig. 1) be the angle of the plan of the corner of the roof and B D the plan of the hip. Draw A D at right angles to A B, and then set up the pitch of the roof A D'.



Bevels for Hip and Valley Tiles.

Draw D' E parallel to A D, making D' E equal to A D' as shown. Now project down from E parallel to A B to meet C B prolonged in F. Then A' F D is the development or true shape of the portion A B C of the plan of the roof, and the bevel K F L that which is required, because F K is parallel to the horizontal joints of the tiles and F L is parallel to the oblique edges meeting at the hip. The method of obtaining the bevel at G will be exactly similar to that already described. In Fig. 2 are shown the bevels for the valley tiles, A B C being the lines of the plates and B D the plan of the valley. The pitches, etc., as will be seen, have been set out on the same principles as previously described, and the bevels obtained by developing portions of the roof surfaces.

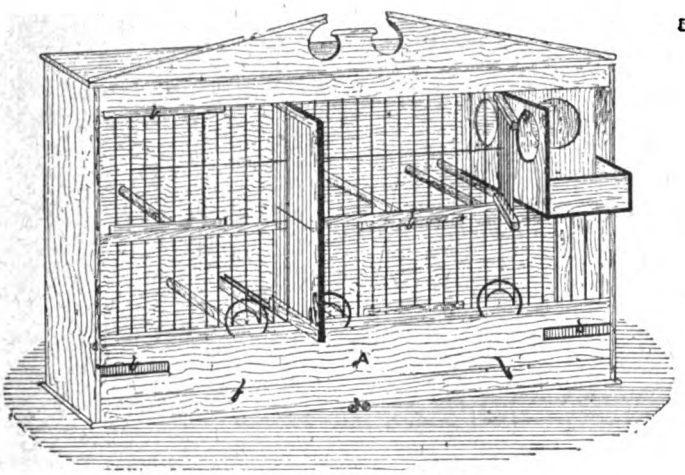
Wood Grain Filler for Coffins.—As a wood grain filler for coffins melted Russian tallow with a quantity of plaster-of-Paris and a trace of yellow ochre added for colouring purposes will be as good as anything if it can be kept handy for use, but if the worker has to make a journey to the workshop and carry the materials with him, whiting mixed with turpentine or linseed oil, with the addition of a small quantity of polish just at the moment of using, is a splendid substitute. The first few rubbers of polish are applied by the polish rubber without a rag covering, and should be worked out fairly dry. The coffin, resting on ledges overhanging the front of the work-bench, is worked upon one side and the foot, and then bodied up and a coat of varnish applied. The coffin is then turned over and the other side and head are similarly treated. Whilst these harden the lid is taken in hand. Returning to the carcase again, the varnished surface is smoothed down with worn glasspaper, and the polish rubber used, this time with a rag covering, a few drops of glaze being added to impart a bright finish instead of spiriting out. If a particularly good surface is desired a second coat of varnish may be applied when the work is taken up the second time. This will of course necessitate the work being handled three times instead of twice, apart from the process of filling the grain.

Furniture Woods.—For constructing a bedroom suite with a limited stock of tools the best hardwood to use is Honduras mahogany. The grain of this wood is fairly homogeneous, straight, and not too open; if the wood is dry it does not cast or twist, is fairly easy to work, is of good appearance when polished in its natural colour, and may easily be darkened to any shade, or, if desired, stained to imitate either rosewood or walnut. Of the hardwoods, oak comes next in ease of working and appearance, but is difficult to keep from warping. Black or American walnut is rather a difficult wood to work, and an inexperienced worker would probably find it "tear up" very much both in planing and glasspapering. Ash also is a very tough and difficult wood to work, but when finished properly has a handsome appearance. For staining purposes, there is nothing better than American yellow pine; it is easy of working, inexpensive, stands well, will stain any colour, polishes well, takes glue admirably, does not split, and its only drawback is that it is very soft and easily damaged; therefore working parts should be edged with a harder wood, such as oak or mahogany. Basswood is somewhat harder, works easy, is cheap, takes stains well, polishes well if properly "filled," but is very liable to warp and twist. Cowrie, or Australian pine, is an excellent all-round wood, fairly cheap, but at times difficult to obtain. American whitewood, which is often confounded with basswood, is a cheap but uncertain wood to handle, and requires considerable care in purchasing; some samples will work as easy as pine, whilst others are more difficult to clean up than oak. White deal (spruce) is unsuited for furniture making, except in the case of table tops or shelves; it is the cheapest wood in the market, but is difficult to work in consequence of the hardness of its knots. It swells and shrinks with every change in the weather, polishes and stains well, and splits easily.

Saddlers' White Wax.—To make white wax as used by saddlers take equal quantities of wax (as used for best white wax candles) and white lead and place in a vessel in an oven to melt; regulate the stiffness by using more or less wax.

Hard Gunmetal Alloy.—A mixture of copper 90¼ lb., tin 9 lb., and phosphorus ¾ lb. is very hard and suitable for axle bearings, cogwheels, and all parts exposed to much friction. The phosphorus must be added to the alloy in the nature of phosphor tin, if the phosphor tin can be obtained of 10-per-cent. standard, which some makers guarantee; otherwise part phosphor copper and part phosphor tin must be used. Taking a 10-per-cent. alloy of tin and phosphorus, melt the ingredients in the following manner. Melt 90¼ lb. of copper in a crucible, and when ready add 2½ lb. of tin, and afterwards 7½ lb. of a 10-per-cent. alloy of phosphorus and tin; keep a layer of charcoal on the crucible, and pour as soon as possible. If this alloy is too hard, use the following. Copper 92¾ lb., tin 7 lb., and phosphorus ¼ lb., using the phosphor-tin alloy to add the phosphorus. ¼ lb. of phosphorus would be contained by 2½ lb. of 10 per cent. phosphor-tin, so therefore 4¾ lb. of tin would be required as well as the alloy.

Cage for Breeding Canaries.—The drawing shows a single-partitioned breeding cage, 22 in. long, 16 in. high, and 12 in. deep. The cage may be made into a two-, three-, or more partitioned one by making it longer in proportion to the number of partitions; practically, 11 in. should be allowed in length for every portion that is to be partitioned off. To construct the cage, a box should be made the required size out of ⅜-in. or ½-in. deal,



Cage for Breeding Canaries.

planed all over. The bottom part A, together with the centre and top bars, should be cut to width and length and drilled together, so that when the wires are threaded through they will run parallel. The nest boxes are made to slide in and out, a small door opening to admit of their doing so. If desired, Hyde's patent feeders may be used instead of the round wires for the bottles. A wire may also be laced in the middle of the top and centre bar to strengthen the wirework. Before inserting the wire front, the box should be well lime-washed inside; the outside may be coloured or enamelled as desired. The cost of wire, wood, and brads should not exceed 3s. 6d. The wire may be obtained from any ironmonger, tinned wire being used as a rule. Any dealer in bird seed or bird requisites can supply the cups; and for wood, apply to a dealer in fret-woods or at a sawmills.

Photographic Actinometer.—An actinometer is an instrument for measuring the actinic or chemical power of light. Papers such as carbon need development to render the picture visible, therefore some means of measuring the light is necessary in order to know precisely when the chemical change is so far advanced that it may be satisfactorily completed by the developer. To make a simple actinometer, prepare ten pieces of tissue paper ½ in. wide, the difference in the lengths of successive pieces being ½ in., so that the longest piece will be 5 in. long and the shortest piece ½ in. long. Paste all the pieces on a sheet of glass one on the other, beginning with the longest, so that they form steps as shown in section by Fig. 1 (an old stripped negative can be used as the support). Then sun down a strip of P.O.P. (about 5 in. by ½ in.) to a medium tint, and tone, fix, and wash as usual. Write on each of the steps (using Stephens' ebony stain or other opaque ink) a number from 1 to 10. Now put the glass containing the steps in the frame, and over it a strip of ordinary P.O.P. The sunned piece of P.O.P. should be cut in half and fastened to the back of the frame, so that the piece of paper being printed will always fold back on it and be easily compared for the tint. Expose to the light for a time, and the paper will darken down beneath each step to the same tint as the sunned piece or guide, the thinnest step, or that marked 1, tinting first. A few experiments will soon show which tint is suitable for an average negative, and this tint is afterwards used as a guide. Another and a better plan, but one involving more time and skill, is to make a gradation scale by actual deposits of silver in the manner described below. Across an ordinary quarter-plate printing frame place a number of strips of card, and cut them to fit together exactly as shown in Fig. 2. Strips B and C hold the others in position. Place in the frame an ordinary slow dry plate with all the strips closed. Now erect the frame facing a candle at a distance from it of 3 ft. See that the candle burns steadily and is not in a draught. Draw out the strips one at a time in regular order, giving each strip an exposure of 1, 2, 4, 8, 16, and 32 seconds respectively. On development in pyro. 4 gr., sodium sulphite 40 gr., sodium carbonate 40 gr., potassium bromide ½ gr., and water 2 oz., a regular series of densities will result. Now make on a film six little photographs of a clear line copy, keeping the impressions at distances apart exactly equal to the

Fig. 1

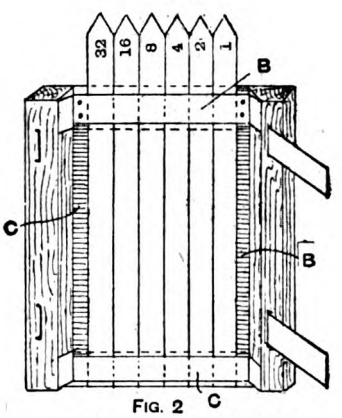


Fig. 2

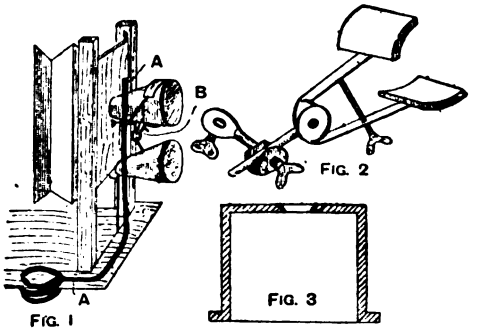
Photographic Actinometer.

width of the strips of deposited silver. (The manner in which this is done is fully described in Series II., p. 168.) Then put the gradation scale face up and over it the duplicated copy, so that one impression comes on each patch of density. Next place over this strip of impressions a strip of similar width of P.O.P. and expose to the light. The impression that must print up clearly to show when an average negative is printed in carbon will be found easily after a few trials. The simplest form of actinometer that will serve as a rough guide for a beginner is to place a strip of P.O.P. across a negative of similar printing density to the one in use. When the silver paper is lightly printed the other will be done also. No allowance must be made for loss in toning and fixing.

Varnishing Photographic Negatives.—Negative varnish is used thus. Warm the negative before a fire or above a gas jet until just hot to the back of the hand, then slowly pour a pool of varnish into the centre of the plate, and tilt the plate to allow the varnish to flow gently to the top right-hand corner, next to the top left-hand corner, thirdly to the bottom left-hand corner almost touching the thumb by which this extreme corner is held, and, lastly, from the bottom right-hand corner pour the surplus varnish gently back into the bottle. Drain for a few seconds and stand up to dry. The plate should not be rocked during the draining. If the varnish is so thick that it forms streaks unless rocked, thin with a little methylated spirit, but do not add too much or the varnish will chill off and dry with a matt surface. Varnish is generally supplied a little too thick for use and becomes worse as the solvents evaporate. After draining, dry for a few minutes with a slow heat. Varnishing negatives requires a little practice; most operators make the mistake of trying to do the work too quickly.

Fixative for Drawings.—A fixative for pencil, chalk, or charcoal drawings is composed of gum juniper or clear resin and methylated spirit in the proportion of 1 oz. of gum or resin to 1 pt. of spirit. As charcoal drawings are too delicate and easily rubbed off for this fixative to be applied with a brush, the preparation is blown on with a spray, which may be bought at any chemist's. It is advisable, when applying the fixative, to stand about 2 ft. from the drawing, which should be set up in a vertical position. If the spray is held too near the drawing, there is a danger of blowing the fixative unequally and in heavy patches, which may tend to disfigure the work. A simple way to fix a pencil drawing is to give it a wash of skim milk.

Photographing Distant Landscapes.—Any ordinary camera and lens may be used successfully for landscape work. Landscapes are usually fairly well lit, and therefore a smaller stop than is required for other work may be used; this is equivalent in many respects to using a proportionately better lens. A lens of fairly long focus (that is, a lens whose length exceeds the diagonal of the plate) should be used for preference, for with such a lens objects are represented larger and in better perspective. This exaggeration in perspective is confined to the near objects, so that if only the centre of the field is used, the result when enlarged will be identical with a picture taken with a lens of longer focus. To produce good landscapes, the photographer must study the rules of composition and of light and shade as set out in Burnet's "Art Essays," Sir Joshua Reynolds' "Discourses on Art," Robinson's "Picture Making by Photography," etc. The photographer should master development and printing and be able to

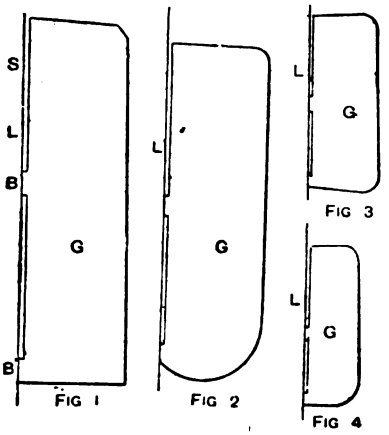


Photographing Distant Landscapes.

expose correctly and tastefully mount and finish the picture. These points are of more importance than the apparatus used for obtaining the picture, provided the camera has the ordinary movements. In a camera which is lacking in extension, something in the nature of a telephoto lens must be used for distant scenes. One barrel of an opera-glass forms a very useful makeshift long-focus or telephoto lens, and is suitable for distant landscapes. Fig. 1 shows a convenient method of using this lens. A is a stout wire bent to form a clamp and easily slipped over the end of the baseboard. Attached to A is an ordinary screw clamp B (see also Fig. 2) gripping the barrel of the glasses. A small box with beading on each edge, as shown in Fig. 3, is made to run in the grooves of the sliding front to increase the extension when required. In the end of this box is a hole lined with black velvet into which the end of the barrel fits exactly. Slip in the box front, unscrew the eyepiece, slip the barrel through the hole, and screw on the eyepiece again from the inside of the camera. A little practice will be required before the extension can be properly adjusted, and then a few trials will be necessary in order to find how much nearer to the lens the plate must be moved after focussing in order to bring the plate into the position of the chemical focus. (As the lens will not be corrected for photography the chemical and visual foci do not coincide.) Choose a clear day, use slow plates, and remember that the exposure is less for distant objects.

Photographing for Reproduction.—Photographs for half-tone reproduction must have great contrast with perfect gradation, and this is best obtained by using slow plates such as Barnet ordinary, and developing with pyro-soda. A good formula is pyro 4 gr., sodium sulphite 40 gr., sodium carbonate 40 gr., water 2 oz., potassium bromide ½ gr. Some fairly dark blue velvet or tapestry forms a good background; if tapestry is used, it should be artistically draped. The trophy should be placed on a table covered with a cloth without pattern, and of nearly the same shade as the background. A piece of ice placed inside a silver cup causes the surface of the silver to become sufficiently dull to prevent reflection. When the trophy presents a large space of plain metal, the lens should be made to peep through a hole in a dark cloth hung up in front of the camera, otherwise the silver will show on its surface an image of the camera. The exposure must be calculated for the object, and not for the background, and in the absence of experience is best found with the aid of an actinometer. As a guide for future use, records should be kept of the exposures and of the results. A negative that is suitable for process reproduction should also yield a good enlargement. But in preparing a negative specially for enlargement, development should not be carried quite so far as for a process negative, and the gradations in the high lights should be preserved. Perfect focussing is imperatively required in both cases.

Gauges for Setting Circular Saws.—Gauges for setting circular saws may be made from a piece of an old thin hand-saw. Shapes of setting gauges are shown at G (Figs. 1, 2, 3, and 4). With a chisel, first cut the piece roughly to size, then secure it in a vice and file to shape. Be careful to file perfectly level, or the set will not be equal on each range. The parts B (Fig. 1) bear against the saw-plate, which is denoted by the line L. The space between the plate and the gauge gives an idea of



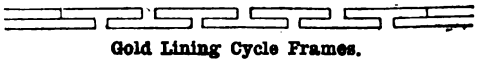
Gauges for Setting Circular Saws.

the amount of set required. The tooth is twisted until the point touches at S. Fig. 1 is a profile of a gauge (half size) suitable for saws from 46 in. to 60 in. in diameter. Set easy to the gauge when setting the smaller saws, and stronger as the saws increase in diameter and thickness. When cutting wet or resinous timber, give a little stronger set. The gauge shown at Fig. 2 is suitable for saws from 30 in. up to 60 in. Gauges for smaller saws should be made suitable to their diameter, thickness, etc. Figs. 3 and 4 are suitable for swage saws; Fig. 3 for saws from 30 in., and Fig. 4 from 20 in. up to 30 in. Set very easy to the gauge when setting the teeth in the smaller saws, and on the bevelled side set stronger to the gauge than on the other side of the saw.

Glazing Drain Pipes.—Only strong refractory clays that will stand a high temperature are fitted for salt-glazing. Though the process is simple, a number of experiments will doubtless be necessary before a satisfactory result is obtained. When the ware has been fired and the kiln is at its full heat, and the fire-holes are bright and clear, a small shovelful of rough salt is thrown into each fire-hole, which is then banked up or covered over. In about an hour the process is repeated, and a trial drawn to see how the glaze is progressing. The salting is again repeated, if need be, and, when considered satisfactory, the kiln is given a final firing and allowed to cool down, a process which may take from twenty-four to thirty-six hours. The same amount of heat required to volatilise the salt would vitrefy ordinary red clay, with the result that the bricks or ware would be stuck together in one mass. In certain yards, where the fireclay is of a particularly refractory nature, it is customary to add a small proportion of red clay. The proportion will, of course, vary according to the nature of the clay, and to ascertain it is a matter of experiment. The advantage of using a small quantity of red is that, since it will flux or vitrefy before the white is very hard baked, it tends to bind the particles in the white together.

Bending Lead Pipes with Bobbins.—A bobbin used for bending lead pipes consists of an egg-shaped piece of very hard wood, a little smaller in diameter than the bore of the pipe that is to be bent. Followers are small pieces of any kind of wood a little smaller than the bobbin. The bobbin is placed in the pipe and driven by a wooden or other kind of rod until the bend is reached. Followers are then inserted, one at a time, and driven by the rod until the bobbin has passed round the bend and has reached the other end of the pipe. A ball of lead, brass, iron, or other heavy material is sometimes used instead of the rod for driving the bobbin. The pipe is stood in such a position that the ball falls into the bobbin, the pipe being then reversed for the ball to run out and be again allowed to fall; or the ball is jerked up and down inside the pipe. A rope with a knotted end is sometimes passed through a hole in the bobbin, and the free end of the rope wound round a small drum fixed on the end of the bench; the small drum is turned by a winch handle, and the bobbin is thus dragged through the pipe and removes all bruises and contracted parts such as at the bends. These methods of bending lead pipes are not at all good, as the heel of the bend is made thin by the bobbin, and the throat of the bend is made very thin, and is sometimes cut through by the rope, especially in pipes that have in them two, three, or more bends. All good plumbers condemn the use of bobbins, because, by the skilful use of dummies and dressers, all bends can be so made that the thickness of the metal is maintained on all sides and for the whole length of the lead pipe.

Gold Lining Cycle Frames.—For putting bright gold lines on cycle frames with gold leaf, a good gold size is necessary, and this is made from ½ lb. linseed oil, with 2 oz. of gum animi, the latter being reduced to a powder and gradually added to the oil while boiling. Boil until as thick as tar, and strain through a coarse cloth. For use, add a little vermilion, and thin with oil of turpentine. Bright gold lines are put on with isinglass. About a quarter teaspoonful of fine isinglass is dissolved in half a cup of boiling water; then, before it is cold, fill the cup



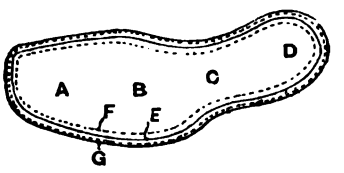
Gold Lining Cycle Frames.

with spirit of wine and strain through silk. After the gold leaf has been put on, run the isinglass size quickly and freely over the lines with a pencil. If applied hot, it enhances the brightness. Gold lines put on dead with a gold size or varnish are burnished with an ordinary agate burnisher, using a piece of thin India paper or silk between the burnisher and the work. The following is very effective. Three lines ½ in. apart are put on with gold leaf. The two top lines are cut at intervals of, say, 1 in., and the bottom line halfway between, as shown by the sketch. A little dead-black is used to cut the lines, and the whole is finished with a coat of varnish.

Measuring Painters' Work.—The correct method of measuring painters' work, such as doors, window frames, etc., is to measure whatever is painted, allowing all returns, panels, etc., stating the number of coats of paint, the finished tint, and if flatted; also if in two tints. Should the mouldings be cut in, collect them by the foot run; if clearcoled, specify the same; if on new plastered walls, describe the same. All painting should mean and include knotting, stopping, preparing, etc. Narrow widths under 14 in., and having two edges, are cut in and taken by the foot run. Door faces (per yard super.): Take the width of the door, including the architraves and returns, adding 1½ in. for every panel by the height from the floor to the top, inclusive of architrave and any grounds. Collect the length of the jamb linings by the widths, adding rebates and thickness of the door; if both sides of the door are painted alike, double the dimension. Wainscotings or panelled dados (per yard super.): Multiply the length by the height, and add 1 in. for all panels, etc., in height only. Window fronts, boxing shutters, etc. (per foot super.): Take the width, including the returns, dead to the walls by the height from t e floor to the top, adding any projection that may occur; take the height of the shutters by the width, adding 2 ft 6 in. for the edgings inside of the boxings, etc. Collect the whole dimensions of round of elbow caps by 10 in. in width. Calculate the sash squares by the dozen, specifying coats; sashes and frames are numbered, stating how many coats. Reveals: Take the heights and soffits by the foot run. Cornices (per foot run): Collect the round; if above 14 in. in girth, take them by the foot super., if under, by the foot run. Particularise if carved or enriched; add one third. Skirtings (per foot run): Take the dimensions of the rooms, describing whether square or moulded. Strings of stairs, handrails, newels, balusters, apron linings, and base mouldings are all measured in a similar way. Rainwater pipes, etc. (per foot run): Add up the lengths of rainwater pipes, eaves, and gutters, and add 2 ft. 6 in. for cistern heads, and 1 ft. 6 in. for shoes. Say how many brackets. Ironwork: Iron, or any other description of railing, is measured as square work. Collect the lengths by the heights; if painted all round, double the dimension. All bars, brackets, etc., are numbered.

Cleaning Papered Ceiling.—Paper that has been on a ceiling for years, and especially if gas-burnt, probably will not clean, but the following method, which answers for wall-papers, may be tried. With a soft-bristle broom remove as much of the dirt and dust as possible, and then rub over the surface of the paper with baker's dough; as the dough gets black with the removed dirt, work the black part into the clean until the dough is all dirty, then take a fresh piece and continue rubbing till the whole area is clean.

Infants' Sewround Shoes.—Here are instructions on making infants' sewround shoes. First of all well wet the leather and then let it get half dry, secure one sole, grain side inwards, to the last by four tacks, as A, B, C, D, and trim it up. Now remove it from the last and put the two pieces together, grain to grain, nail them on a cutting board, the trimmed piece on top, and cut out the bottom piece exactly to the top piece. Then tack the soles on the board separately, grain downwards, and take a sloping piece off all round the edge, as shown by the middle line E, so as to have the edge of the sole about half its original substance. This is best done by drawing with compasses a line all round about $\frac{1}{16}$ in. from the edge, then draw



Infants Sewrounds.

another line $\frac{1}{16}$ in. inside the first line. Make a row of holes, bringing the point of the sewing awl just above the edge of the sole; that is, put the awl in at F, and just let the point show at G. After this has been done to both pieces, the soles are fitted. Side linings and stiffeners are fitted as for other boots, in proportion to the size and substance of the work in hand. The soles are then tacked, grain down, on the lasts and the shoes lasted. All single-sole work is lasted inside, outside; for instance, the left shoe is made on the right last and *vice versa*, then, when sewn and turned, the shoes are re-lasted on their proper lasts, finished off, removed from the lasts, and socked in the usual way The whole of the above, up to re-lasting, has to be done while the sole is fairly wet; if allowed to get dry, it must be damped again with an old toothbrush.

Repairing Valve of Oil Lamp Pump.—For repairing the valve of the pump of a Primus oil lamp it will of course be necessary to take out the valve. Examine the interior of the pump-barrel, and if a small flat-sided projection on the bottom of the pump is seen, that is the end of the valve; and if a long key with an aperture in the end, which is made to just fit over the projection above mentioned, be passed down the pump-barrel, the valve can be unscrewed, repaired, and reinserted. If there is no projection, the pump-barrel will have to be taken out. If the part of the pump that projects from the reservoir is hexagonal at the head, then the pump-barrel will unscrew from the reservoir, and the valve on the end can then be adjusted. If the pump is not hexagonal at the head, the lamp is of an early pattern, and the pump will have to be unsoldered before it can be removed. Gently heat the pump with a blowpipe flame until the solder melts, then pull the pump out. Before commencing this operation, drain all the oil from the reservoir, and leave the feed-cap off while removing the pump, and keep the cap opening away from the operator while using the blowpipe, as the smallest amount of oil remaining in the reservoir will be converted by the heat applied to gas, and if the flame catches this a slight explosion in the reservoir will occur, the flame from this shooting upwards through the feed-cap opening. The defect in the valve may be from three causes: the cork washer may be worn out; the spring through much use may have become weak; or dirt may have worked into the valve and so rendered it unsound. The obvious remedy before replacing the pump would be to fit a new spring or washer, or thoroughly to clean the valve.

American Log Cabin. — The illustrations show a common form of log cabin built up of small straight tree trunks. The usual method of joining the timbers at the angles is to let the ends run over and notch a quarter of the thickness out of each side of each piece, as shown in Fig. 4. These logs can be further secured by boring with an auger through each log into the last log fixed, and driving in a wooden pin. Of course, if nails are obtainable, the work would be expedited. If a chimney is required, it should be built of some local stone or similar material. But American

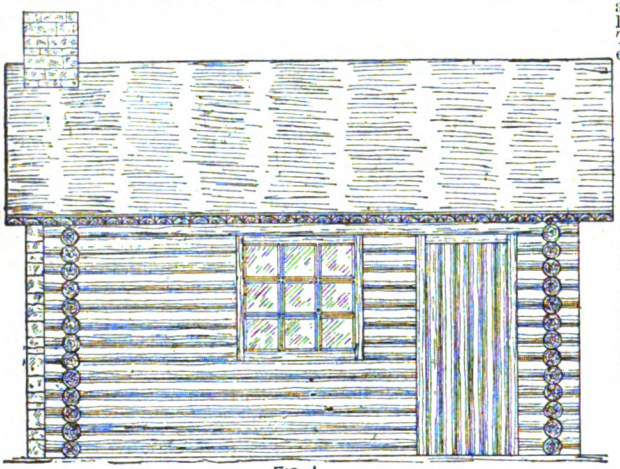


FIG. 1

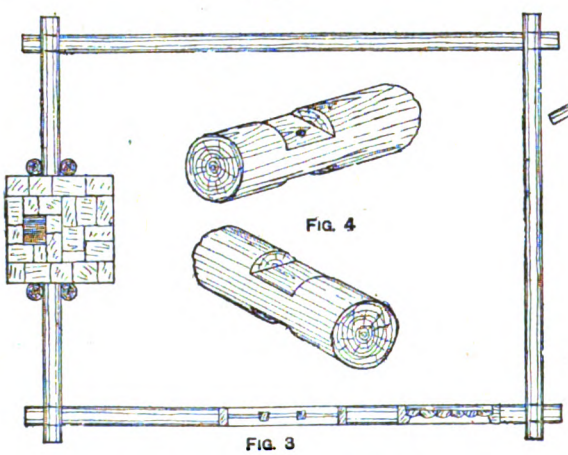


FIG. 4

FIG. 3

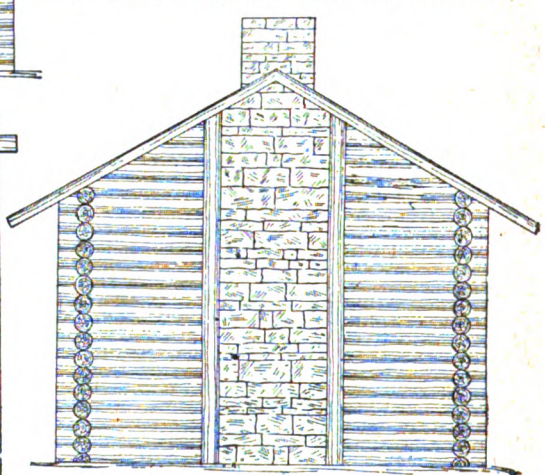


FIG. 2

American Log Cabin.

stoves with piping are sometimes used for the purpose. The roof is often formed by splitting the logs in two, as shown, and is covered with some kind of material (handy or easily obtainable) that will render the roof waterproof. The expedients adopted for making the inside of the structure draught- and waterproof are various, and depend upon the district and the resources of the builder. The sizes of the cabins vary according to requirements. Fig. 1 represents the front elevation, Fig. 2 an end view, and Fig. 3 the plan.

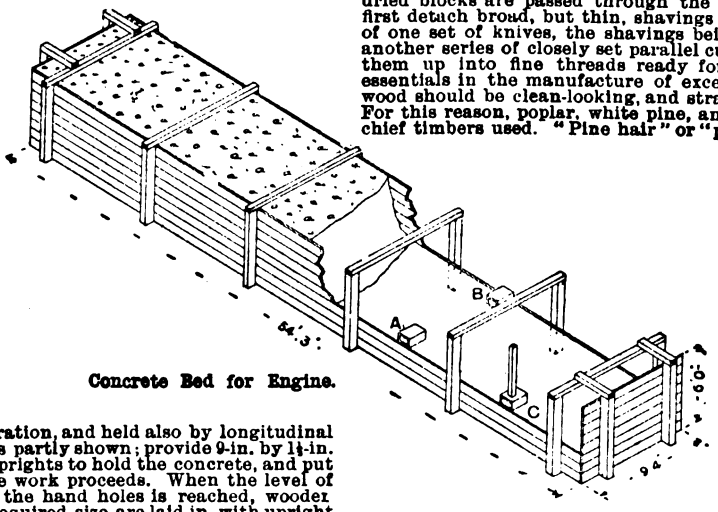
Feeding Maxim and Nordenfelt Guns.—The Maxim and the Nordenfelt guns are automatic, the Maxim having a single barrel, and the Nordenfelt from one to ten barrels. The Maxim gun is supplied with ammunition by means of a belt holding 250 cartridges. The belt passes through a feed-block on the right-hand side of the gun, and is caught by pawls, which hold it and pass it to the left. A cartridge is withdrawn by the extractor, and brought into line with the barrel as the extractor falls. The belt is furnished with projecting brass strips to show how far the cartridges are to be inserted, and each strip is thickened at the edge next the bullets, so that the cartridges may be kept parallel in passing through the feed-block and may lie even in the ammunition boxes. When the gun has fired, the recoiling portion travels forward and moves the upper pawls on to the feed-block slide to the left, and brings a fresh cartridge into position in the feed-block. The feed-block moves forward into the firing position, the fresh cartridge and the empty case are placed in the barrel chamber, and the ejector tube and the extractor are moved upwards by the side levers acting on the extractor levers, the empty case remaining in the extractor tube and being held there by the extractor spring until it is pushed out by the next case. Then the jib slides over the base of the live cartridge until the firing pin-hole is opposite the cap, and a fresh cartridge, automatically moved up, comes into position in the feed-block. The rifle-calibre Nordenfelt guns are fed by means of upper and lower hoppers, the latter being more often termed the distributors. They are constructed of steel plates, with the exception of the rear face and guides, which are of gunmetal. The lower hopper is placed on the gun on the top of the breech cover over the carrier block, and secured in position, where it remains during the firing, by means of a spring lock. The lower hopper, or distributor, has a separate compartment for each barrel, and on the rear face of each compartment is a guide for holding the cartridges by their rims. The cartridge lies in an inclined position with the bullet slightly raised and touching the front inner face of the distributor. The upper hopper also has separate compartments, and is loaded from the top, a hinged cover being provided for the purpose. The cartridges are kept on the hopper by means of a catch running the whole of its width, in rear, at the bottom. This catch can be thrown in or out of position by a handle on the left outer side hopper. A similar arrangement of catch is used for the distributor. The empty lower hopper or distributor being fixed in its place, an upper filled hopper is then placed on the top of the lower one, and on the catch handle being pushed down the cartridges are released, and thus fall into their respective compartments in the distributor. When the catch of the distributor is released a cartridge for each barrel falls on to the carrier block, the others continuing to supply their places as soon as a vacancy occurs. By means of the catch the distributor and upper hopper can be taken off separately at any time without the cartridges contained falling out. This method of feeding is very simple and certain; and the cartridges being contained in a closed case, any chance of the gun being fouled by dust collecting on the cartridges is obviated.

Yellow Glazes for Leather.—For bright yellow glazes for leather, (1) dissolve 1 oz. of gum sandarach and 1 oz. of orange shellac in ½ pt. of methylated spirit; then stir in sufficient aniline yellow (soluble in spirits) to colour. Strain and mix with the whites of four eggs; apply quickly and evenly. If required, thin down with methylated spirit. (2) Dissolve 12 oz. of shellac, 2 oz. of resin, 5 oz. of Venice turpentine, and 4 oz. of spirits of turpentine in 96 parts of methylated spirit; add 1 oz. of aniline yellow and stir well; then pass through a fine strainer, when the mixture is ready for use. Apply with a camel-hair brush. If a light shade is required, add aniline yellow; for deep colour add a very small quantity of Bismarck brown. Thin down with methylated spirit.

Poplar or Aspen Wood.—Aspen or poplar wood is white in colour, easy to work, and finishes with a smooth, glossy surface. It is soft, very light in weight, and does not burn readily. It is used for wooden ware, for heads and handles of house brushes, for shelves, boxes, and corn-bins (mice do not nibble it), and very frequently for partitions, stalls, and flooring-boards in outhouses and farm buildings.

Colouring Cinematograph Films.—The simplest plan for colouring cinematograph films is to use aniline dyes. The film is stretched between two clips over a board having a small hole in the centre, beneath which is a reflector or an incandescent lamp. By using this device the film is in a horizontal position, and the light shines through the picture. Washes of the dyes are then applied with a brush, any excess being removed with the edge of a piece of blotting paper. To colour these films in a really effective manner requires considerable skill and patience, and the results are always rather disappointing. Of course, only general effects are aimed at, and not minute detail.

Concrete Bed for Engine.—In a concrete bed for an engine, hand holes are to be left for tightening the bolts. The size of the bed is 54 ft. 3 in. by 9 ft. 4 in. by 6 ft. thick. The timbers may be fixed by providing, say 6-in. by 4-in. uprights 10 ft. apart, let 1 ft. into the ground with cross pieces at the top to hold them to the gauge, as



Concrete Bed for Engine.

shown in the illustration, and held also by longitudinal pieces on the top, as partly shown; provide 9-in. by 1½-in. boards inside the uprights to hold the concrete, and put the boards in as the work proceeds. When the level of the under side of the hand holes is reached, wooden boxes A B C of the required size are laid in, with upright boxes, say 3 in. by 3 in., to form the core for the bolt holes, one of which is shown in the illustration. These core boxes should be carefully fixed to the template or measurements. The concrete should be put in in layers not exceeding 12 in. deep, no layer to extend more than 3 ft. in advance of the layer above.

Ridding Water Pipes of the Odour of Gas.—Iron pipes temporarily employed for a gas service and subsequently used for a domestic water supply may cause the water to be tainted with the odour of gas. The odour will probably soon disappear, but in the meantime a solution of permanganate of potash might be tried. Purchase at an oilman's a pennyworth of permanganate of potash and dissolve it in a good pailful of warm water. Run this solution through the pipes, then flush them with plain cold water. Do not allow any of the undissolved permanganate to enter the pipes, or further trouble will be experienced in trying to rid the water of the pink colour caused by the undissolved grains of the permanganate remaining in the pipes. Permanganate of potash used in this way is harmless. If necessary try the effect of running a pailful of lime-white through the pipes. Make this lime-white with fresh (quick) lime and water; and the solution should be about as thick as good milk.

Definition of Centre of Gravity.—The centre of gravity may be defined as that point in a body through which the resultant of the gravities (or weights) of the parts of that body passes, in every position the body can assume. If the centre of gravity be supported, the whole body will be supported in equilibrium. But the centre of gravity is not necessarily situated in the solid portion of the body, nor enclosed by its surfaces; the centre of gravity is simply the mean central point of the mass, and in such cases the statement of support will not hold good unless the centre of gravity point be connected with the body. In plain words, the centre of gravity of any figure is that point about which the figure balances. The centre of gravity of two weights, or areas A and B, placed l distance apart, will be x distance from A when

$$x = \frac{B}{A + B} l.$$

The centre of gravity x of a number of bodies in a straight line with regard to any point A at one end of line, W being the weight and z the distance of W from A,

$$A\,x = \frac{W z + W_1 z_1 + W_2 z_3 + \ldots.}{W + W_1 + W_2 + \ldots.}$$

On this principle all cases arising in practice are worked out, but sometimes one method and sometimes another is better suited to the particular case.

"Excelsior" and "Pine Hair."—"Excelsior" is the name given to the very finely cut and ribbon-like wood shavings used for packing all manner of delicate objects. A dozen different kinds of machines are used for reducing the rough lumber to the fine finished product. The work is carried on chiefly in America. After cutting the rough logs off to the right lengths, peeling the bark off, and chipping out all knots and discoloured places, the wood is placed aside to dry thoroughly. Meanwhile, other dried blocks are passed through the machines, which first detach broad, but thin, shavings by the operation of one set of knives, the shavings being conducted to another series of closely set parallel cutters which split them up into fine threads ready for use. The first essentials in the manufacture of excelsior is that the wood should be clean-looking, and straight in the fibre. For this reason, poplar, white pine, and spruce are the chief timbers used. "Pine hair" or "pine wool" is also of American origin. It is a fibrous preparation of the long, needle-like leaves of the true pitchpine, and of other pine trees that have very long foliage. The leaves are subjected to the action of special machines that clean, dress, and split up the "needles" to the requisite degree of fineness. The material is sold in four grades, A, B, and C, a coarser article D being used as a substitute for real hair in plasterers' work. The finer grades are used for upholstering purposes and for weaving into mattings and carpets. The finest "pine wool," especially, is claimed to be the nearest approach to natural wool ever made from vegetable fibre. It takes and retains dyes without the need of a mordant, while the "pine hair" is clean and sweet, has a healthy balsamic odour, is permanently antiseptic, and goods manufactured of it are said to be absolutely vermin-proof. As a bye-product in the preparation of pine hair and pine wool, pine dust is becoming well known. It is used as a fertiliser, and contains a high percentage of ammonia.

Moulds for Sealing Wax.—A brass mould for sealing wax is a flat block cast with depressions on the face of it the size of the sticks. These depressions should be very slightly tapered, and the casting must be smoothed and polished. A little oil applied by a rag before casting will help to remove the sticks, but the taper shape of the depression is essential. The wax should not be hotter than is necessary. Iron moulds would probably do provided they are properly tooled and polished. The sticks are cast quite plain, and when a name is to be applied the sticks are laid on sheet-iron trays and placed in an oven hot enough to just soften the wax, and whilst the wax is in this condition the impression is produced by applying a small hand stamp to each stick.

Mounting Photographs on Plush Blocks.—Albumen paper is most suitable for photographic prints that are to be mounted under glass on plush blocks. Thoroughly clean the glass support and lay over it a thin sheet of perfectly flat metal ⅛ in. smaller each way than the glass. This metal will form a mask for the centre of the glass and leave a clean edge, when a brush charged with oil colour is run around the glass. Varnish when dry. (The better plan is to purchase these glasses ready prepared. They can be had in set sizes of any dealer in photographic materials, and are known as opaline glasses.) Place the glass in warm water, and make up a 5-per-cent. solution of No. 1 gelatine and keep it warm. The print, which must be trimmed somewhat smaller than the glass support, is, together with the glass, placed in this gelatine solution. The print and the glass are immersed in the gelatine, are brought into contact under the surface, withdrawn, covered with a sheet of rubber backing, and stroked into close contact with a flat squeegee. See that no air bells (which show like bright specks from the front) appear on the print; if any are found, stroke them out by gentle pressure with the squeegee. When dry, back the print with a sheet of waterproof backing paper, sponge off the gelatine from the front of the glass (using warm water), and, after again drying, the opaline is ready for glueing to its support.

Perforated Window Blinds.—Window blinds in wire gauze or perforated zinc are made as shown by Figs. 1 and 2. A light mahogany frame fits into the opening of the sash frame between the beads, the latter being usually 1½ in. wide, so that the blind frame from the face to the outer edge of the capping should measure 1⅛ in. The

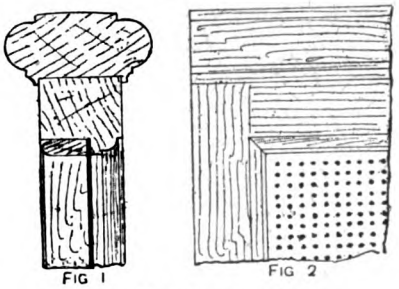


FIG 1 FIG 2

Perforated Window Blinds.

moulding on the inner edge or next the glass should be cut in between the sash stiles. The blind is fixed by two blind bolts, one at each end of the capping, the bolt shooting into the bead on the sash frame. For panels, either gauze or perforated zinc is used, preferably the latter, especially when writing is to be done on the panel.

Taking Apart Shuttle Race of Sewing Machine.—To take apart and, after it has been cleaned, replace the shuttle race of a Singer sewing machine it is necessary merely to remove the race from the machine and then take out the two screws on the back. The shuttle is put in with the race, and it is only necessary to have the needle-bar at the top of its stroke when the shuttle (if put in the race with the point about level with the centre of the top part of the race) will slip into place quite easily. To adjust the height of the needle-bar, fix it so that when at its lowest point the eye of the needle is just above the shuttle driver.

Testing Brazed Joints of Cycle Frame.—Cycle frame tubes could be tested by standing on the pedals, but this is not an absolute test. A top brazed joint—that is, one in which the brass has not run into the joint, but only round the top—would probably stand any amount of pulling or twisting; but the vibration while riding would crack the brass—the joint not being solid—and the tube would naturally come out of the lug. The only way to be sure of a good brazed joint is to clean the parts, peg, heat sufficiently, and see that the brass runs into the joint, and that it is filled up, making the two parts solid.

Colouring Gelatino-chloride Photographic Prints.—For colouring gelatino-chloride prints so as to leave them glossy like ordinary uncoloured prints, it is usual to employ ordinary water-colours mixed with gum to match the surface of the print. Dissolve a few lumps of gum arabic by gentle heat in a small quantity of water, filter, and add this to the paint employed. The following is a fairly complete equipment of colours. Rose madder, crimson lake, venetian red, light red, vermilion, yellow ochre, cadmium yellow, Naples yellow, raw sienna, burnt umber, warm sepia, cobalt, Prussian blue, ivory black, and Chinese white, but different artists will obtain the same effects with different mixtures. Sets of colours for photographic work can be obtained of any large artists' colourman. A popular method of colouring is not proper painting, but merely a trick of dabbing over solutions of aniline dyes.

Fixing Kitchener and Hot-water Pipes.—The manner in which a kitchener, with hot water to sink and bath, is fixed, is shown by the accompanying illustrations, of which Fig. 1 illustrates the range, boiler, and pipes in elevation, and Fig. 2 the range in plan. The flues of kitcheners vary a little in size

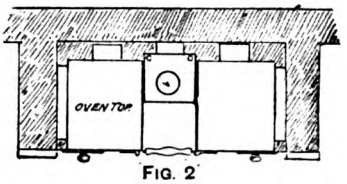


FIG. 2

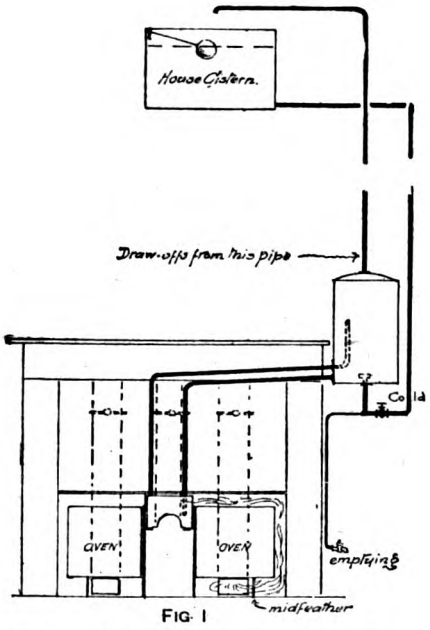


FIG 1

Fixing Kitchener and Hot-water Pipes.

according to the sizes of the ovens and the fire, but the back upright flues may be safely made the same size as the dampers sent by the range maker. The sides of the ovens nearest the fire are arranged differently in different ranges, some having an iron plate reaching from top to bottom, the upper part of the plate having a ledge for the fire-brick to rest on; in other ranges this division must be built up in 4½-in. brickwork. The flues over the tops of the ovens are about 2½ in., and down the outer sides of the ovens are about 1½ in., but both these are controlled by the castings. The flues under the ovens are about 3 in. The sizes of the boiler and the cylinder depend on the requirements, also on the size of the fire. The cylinder system of apparatus is shown, but the tank system is sometimes preferable if the water supply is regular.

Coke Breeze Bricks.—Breeze bricks of the unbaked kind may be made of coke breeze and Portland cement, in the proportions of 2 parts breeze to 1 part cement, made in a mould and left for seven or eight days to set. If baked, clay and coke breeze in equal proportions should be carefully mixed, placed in a mould, air dried, and then burnt in a kiln in the ordinary way.

Shampoo Stand.—The simplest shampoo stand is a very large wash-basin with marble top, or a basin and top in one piece of earthenware, supported on a stand or on a bracket fixed to the wall. The basin should have a plugged and grated waste-outlet and an overflow arm. The waste-pipe should be trapped and fixed to discharge into a gulley-trap outside the shop. Hot and cold water should be supplied, the hot water from a tank with circulation pipes to a boiler, or from a heater. The shampoo-cock should be made so that the supplies of hot and cold water can be regulated. A short flexible hose-pipe and rose or spreader should be attached to the cock. The whole of the fittings can be bought much cheaper than they can be made.

Plait Mill.—Figs. 1 and 2 show elevations of what is commonly known as a plait mill, used in rustic districts where straw plait is made, to roll or "mill" the straws to make them pliable. Beech is suitable for its construction, but the screw is boxwood. The handle and rollers may be prepared by a local turner, if the maker has not got a lathe. All joints must be painted with white-lead, red-lead, and linseed oil paint, and all parts where friction occurs are blackleaded. The stiles A are 1½ in. by 3 in.,

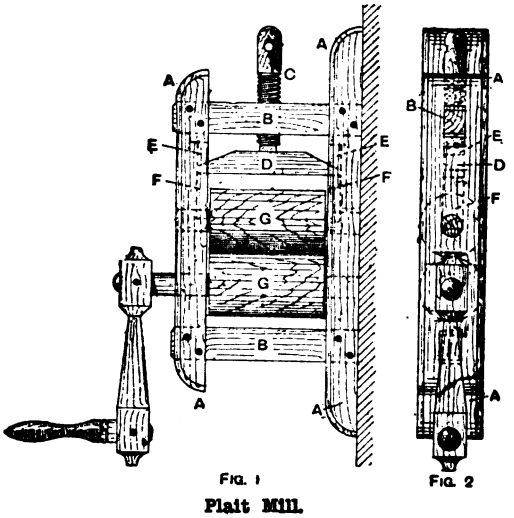


FIG. 1 FIG. 2

Plait Mill.

and are placed 5½ in. apart, and chamfered and rounded at the top and bottom. The front one is 1 ft. 3 in. long, and the back one, which is fixed to the wall, is 1 ft. 7 in. long. The rails B are tenoned into the stiles with 1 in. tenons (see Fig. 1) which project ¼ in. in the front, the end being chamfered; they are fastened with hardwood pegs, and the top one is tapped to receive the tightening screw C which presses on the cross piece D. This again slides in a slot E, 1 in. deep and 1 in. wide, and presses a hardwood block F which also slides in the slot, the bottom of the block being hollowed to suit the spindle of the top roller. There is a block on each side. The rollers G are of 3-in. sycamore with 1-in. spindles; those of the top roller are 1 in. long, but the bottom one is carried out 2½ in. beyond the stile, and to it the handle is fixed, the end being left square. The sweep is 10 in. long, 1¼-in. by 1¼-in. stuff being used, and the handle is 6½ in. long, including tenon, and 1 in. by 1 in. in section. The sweep and handle are fastened by pegs.

Black Varnish for Iron Castings.—There is difficulty in obtaining or mixing preservative preparations for new iron castings, but the following may be used with advantage on all kinds of new castings, drain pipes, and ornamental ironwork exposed to atmospheric influences. Melt 12 gal. of coal tar in a copper or other suitable vessel heated to about 250° F., then sprinkle 3 lb. of quicklime into it while constantly stirring, add 7 lb. of coal-tar pitch and 2 lb. of resin, and stir continually until the latter is dissolved; then add 3 gal. of boiled linseed oil, stir well and pass through a strainer, when the composition is ready for use. The addition of lime drives away or neutralises any free acid in the tar, which would eventually have a corrosive action on the iron. For heavy castings, a method often adopted is to place sufficient of the preparation in a suitable tank, which is heated to 200° F., and the castings are dipped into the tank by means of overhead travelling cranes or pulley blocks. Another method is to heat the castings slightly and dip them into the preparation which is cold. The hot castings turn the varnish thin, and it readily enters the pores of the iron. The preparation in a few hours dries hard with a good gloss, which is tenacious and not brittle. It may be used cold and applied with a brush, provided a small quantity of coal-tar naphtha and lamp-black is added, but it should on no account be heated after adding naphtha, which hastens the drying somewhat, whilst the lampblack gives it better covering properties. It then dries with a good gloss in about three hours, and may be found useful where a quick finish is required.

Bending Cycle Handle-bars.—A cycle handle-bar is cut with a hack saw or tube cutter, then loaded with caster's fine dry sand, and the ends are plugged up. Mark with chalk where the bend is required, or fix a stop on the bending block, heat to a dull red, and draw round a grooved bending block of the required shape. A bar could be altered in this way, made narrower, or turned up, etc., without the block. Heat in the right place, hold the end in a tube clamp, bend one side as required, and then the other to correspond. The tube must be packed tight with sand otherwise it will buckle. When bent cold, the tube is filled with pitch, or a flexible mandril is passed through, and drawn round a bending block.

Mould for Plate Spelter.—A mould made to the illustrations (Figs. 1 and 2) will probably answer for casting re-melted scrap zinc into cakes of spelter. Scrap spelter is generally smelted, with other material containing zinc as ore or refuse, in a reverberatory furnace in quantities of several tons at a time. The mould is of iron, flat, open-topped, with raised letters on the

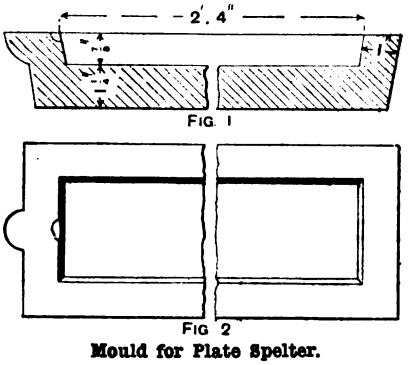


FIG. 1

FIG 2

Mould for Plate Spelter.

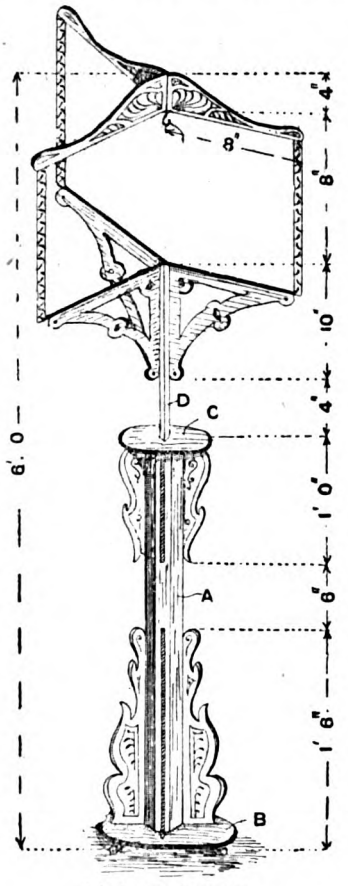
bottom, which are reproduced on the plate of spelter. The size of the mould varies, some plates being about 15 in. by 10 in. by 1½ in. thick, others of crown spelter being about 2½ in. by 9 in. by ¾ in. thick. The thickness of the iron in the mould need not be more than 1½ in. at the bottom by 1 in. at the sides. In the illustration the cup at the side is for pouring the metal. If the metal is quite clear and free from dross, it can be poured into the open ingots and give a good top surface. Great care is needed not to overheat the metal to the point of volatilisation.

Wax Solution for Glazing Prints.—In a waxing solution for use in glazing photographic prints the kind of wax used is not of much importance, but white wax is generally employed; the quantities are also open to considerable variation. Shred up some white wax and dissolve it in a sufficient quantity of benzole or turpentine; wax 10 gr., benzole 1 oz., are good proportions. Moisten a flannel with the solution, rub the print evenly all over, and finish by polishing thoroughly with a dry cloth.

Bleaching and Blocking Panama Hat.—For bleaching a Panama grass hat, it first should be thoroughly washed by passing it several times through a hot soap solution, and then rinsed in hot soft water. Bleaching may best be performed by sulphurous acid as follows. Hang the damp hat by a cord high up inside a large box or barrel which should be placed, inverted, in the open air over a small heap, say 1 oz., of powdered sulphur; set fire to the sulphur by means of a red-hot poker, and rest one edge of the box or barrel on a brick so that air may reach the sulphur and keep it burning. After bleaching, the hat may be rinsed again in hot water to remove the excess of acid. Blocking should be done on blocks, but may be carried out by dipping the hat in a weak size made from white gelatine and, when nearly dry, ironing with a warm iron covered with linen on any support that may be handy.

Hardening Face of Steel Hammer.—To harden a cast-steel hammer so that the centre of the face will be as hard as the edges, heat the face to a cherry red, and see that it is the same heat in the centre as at the edges. Then, when cooling the face in the water, keep moving it about until it is quite cold; brighten it up with a rub stone and let down to a deep straw colour.

Birdcage Support.—The accompanying illustration shows a useful and ornamental birdcage support. First, a length A of 4-in. quartering is required, and its edges should be planed off till the section is a perfect octagon. A disc of wood B, 10in. in diameter, screwed on the bottom, with four small feet, forms the base. A disc C, 8in. in diameter, is screwed on the top of the column, and a hole drilled through this and into the column to a total depth of 6in. to admit the upright D of the top portion. On four sides of the column ornamental pieces, or fretwork, should be fastened, and the top triangular



Birdcage Support.

portion is also made of carved wood or fretwork, supported on a triangular upright, the bottom of which is rounded to fit in the hole in the column, but not fastened. A hook E is screwed into a small triangular-shaped piece of wood to hang the birdcage on, and to which the three top pieces are fastened. The whole stand may be made in any of the usual cabinet woods, and it should be stained and varnished to match the furniture.

Artists' Oil and Water Colours.—To manufacture artists' oil colours from raw materials requires special knowledge and apparatus. The simplest and cheapest method is to obtain the colours in their pure state, dry, from a colour manufacturer and grind them under a pestle and mortar, a palette knife on a marble slab, or through a small hand-power cone paint mill, using as a medium for the dark colours raw linseed oil, and for the light or delicate colours refined linseed or poppy oil, which would not affect or change the delicate colours. In each case the pigments should be ground perfectly fine and free from grit, and a small sample thus ground should be rubbed out in an almost transparent layer on a piece of ordinary sheet glass, when the fineness of the pigment may easily be determined. The colours are then placed in collapsible tubes, which keep them in their paste state. The cost of the dry colour will vary according to the class of pigment required. For water colours, the pigments are obtained as above and ground in water in which a little gum arabic has been dissolved, about 1 oz. to 1 pt. of boiling water; they are then placed in wood or brass moulds of various dimensions, and dried in a warm atmosphere. Some makers place their water colours in a moist state in collapsible tubes, this method being much better than the block colours, as they are always moist, ready for use. The following is a list of colours usually found on an artist's palette board. For red: vermilion, carmine madder, light or venetian red. For yellow: yellow ochre, lemon yellow, orange cadmium. For brown: burnt sienna, raw and burnt Turkey umbers, sepia, vandyke brown. For blue: cobalt, Prussian and ultramarine blues. For black: ivory black and lampblack. For white: flake white and zinc white. Comprehensive formulæ for mixing the various tints and colours will be found on p. 31.

Boring Holes in Birdcage and Aviary Construction.—Fig. 1 shows the kind of bit that is used for making the holes; the small round piece of metal A is soldered to the bit to prevent it penetrating into the wood too far and making the holes too large. Bands for birdcages are made as follows. The wood, which may

FIG. 1

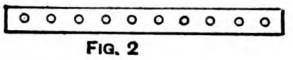


FIG. 2

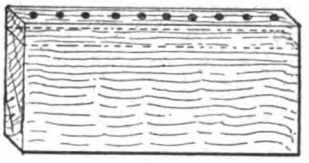


FIG. 3

Wooden Bands for Birdcages and Aviaries.

be either mahogany or deal ⅛ in. in thickness, is planed up, then a metal guide (Fig. 2) is tacked on the edge and the holes are drilled in the wood through the metal guide. This is then taken off and a band is cut off the wood, using an ordinary mortise gauge having the point knocked out and a small blade inserted. After cutting off the band, on examination it will be found that the bit has pierced the wood sufficiently far to mark the holes for the next band to be bored. Fig. 3 shows the wood with the first band bored, the dotted lines indicating where the cutting gauge will cut it off for the first and second bands. For a metal guide, procure from a case maker an inside metal band; this will have the holes punched in at the proper distances, and may be had almost any length.

Fixing Soles to Rubber Boots.—A cement that has been found very satisfactory for fixing soles to rubber boots is made as follows. Solution (1), chloroform 280 parts, masticated indiarubber 10 parts. Solution (2), indiarubber 10 parts, resin 4 parts, Venice turpentine 2 parts, and oil of turpentine 40 parts. Dissolve solution (1) by mastication. For solution (2), melt the finely divided rubber in the resin, add the Venice turpentine, and finally the oil of turpentine; use heat if necessary. Mix the two solutions together finally. Saturate a piece of linen with the cement and apply to the part previously coated with the cement; as it dries apply more as required, and finally bring the two parts together. The following is a simple preparation for repairing rubber shoes. Pour 12 to 14 parts of carbon disulphide over 2 parts of rubber cut into small pieces; let the vessel containing the above stand in a water bath at 86° F. until the solution is effected. The solution is of a paste-like consistency, and to prevent it hardening too rapidly reduce it with a solution of rubber and colophony in oil of turpentine. To prepare this, melt at a moderate heat 1 part of rubber, and add to it ½ part of colophony; then add the required quantity of oil of turpentine and thoroughly incorporate.

Gilding Cardboard Mounts.—For gilding the edges of cardboard mounts a laying press, a steel scraper, and a burnisher are used. The cards are knocked up evenly, placed between gilding boards in the press, and screwed up very tight; the edges are then scraped smooth with the scraper. A preparation of Armenian bole and black-lead is then brushed over the edges. When dry, they are treated with size composed of white of egg beaten up to which water is added—one egg to 1 pt. of water. The size is put on with a broad camel-hair brush. While still wet, the leaf gold is laid on and allowed to dry thoroughly, after which it is burnished.

Splicing Wire Rope.—Wire rope is spliced in one of two ways according to the illustrations below. The short splice is used when bulge or bunch is not of consequence in cases of moderate stress; the long splice ensures uniform diameter and no diminution of strength. Hemp and wire ropes are spliced in the same way, except that in the latter the splice is longer. For making a short splice, unlay the three or six strands, as the case may be, for from 6 in. to 12 in., the actual distance depending

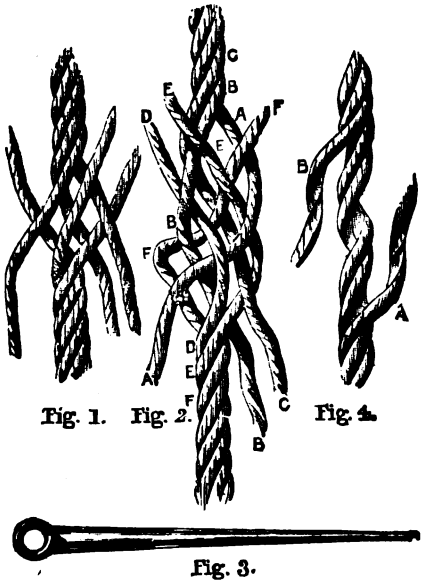


Fig. 1. Fig. 2. Fig. 4.

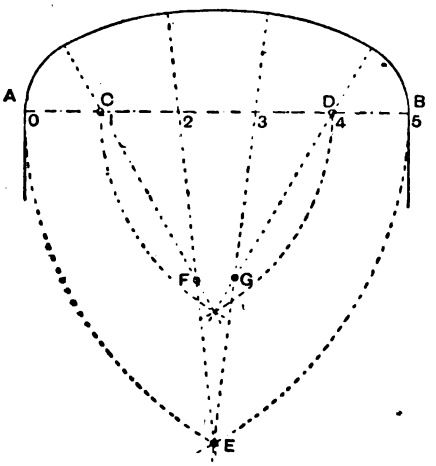
Fig. 3.

Splicing Wire Rope.

on the size of the rope and the required strength of the splice. Open out the strands and place them together in alternate positions, as shown in Fig. 1, this operation being known as "marrying" the ends. Pass each strand over and under the next strands, three, four, or six times in succession. Fig. 2 shows the interlacing of the opposed sets of strands once before the rope is pulled taut. The letters show the positions of the individual strands. Now grease the strands, make a way between them in the rope by thrusting in an iron marlinespike (Fig. 3), then pull the strands as tight as possible and roll the splice between boards or under foot so that the diameter may be increased as little as possible. For making the long splice, unlay the strands in the two rope ends for a considerable distance, and lay the one set of strands A (Fig. 4) in the groove left by unlaying B. When a sufficient length has been treated by unwinding and unlaying all the strands in succession, unite the ends by thrusting them through openings made by the marlinespike, as in ordinary splicing, and then the splice being very long will be scarcely perceptible. The rope ends are held in their sockets by pins.

Paste for Wall-papers.—Elastic or pliable paste for wall-paper may be made as follows. Take 8 oz. of ordinary starch, 3 oz. of white dextrine, 22 fl. oz. of cold water, 2 oz. of borax, 6 oz. of glycerine, and 1 gal. of boiling water. Mix the starch and dextrine with the cold water to a batter. In another vessel dissolve the borax in the boiling water, then add to it the glycerine; then add gradually to the starch while constantly stirring, when it will turn into a translucent paste. This paste will not crack, but is very pliable; and may be used with advantage where flexibility is required, as on expensive papers. Strong adhesive paste for heavy papers may be prepared by mixing 8 lb. of rye flour into a batter free from lumps with 1 gal. of cold water; then add steadily 3 gal. of boiling water, constantly stirring; after which, ½ lb. of powdered resin should be gently sprinkled in, a little at a time. Should the paste become thick when cold, thin as required with hot water. This is a good paste, and may be used for hanging heavy wall-papers or leather. The following are the ingredients for the well-known Venetian paste. Fish glue 8 oz., cold water 16 oz., Venice turpentine 4 oz., rye flour 2 lb., boiling water 1 gal. Dissolve the glue in a glue pot with the cold water in a water bath or over a fire; then stir in the Venice turpentine. In another vessel dissolve or make a batter of the rye flour with 2 pt. of cold water, then add while constantly stirring the boiling water. The contents of the two vessels should now be stirred well together. This makes a paste that is very tenacious, and, owing to the Venice turpentine in its composition, will make the paper adhere firmly to any painted surface. Lincrusta-Walton may be hung with a paste made by dissolving with boiling water 1 lb. of best Scotch glue and adding to a paste made from 3 lb. of best flour; apply it very thick, and in a warm room.

Setting Out Five-centred Arch.—The accompanying diagram shows how to get the radius points for a five-centred arch. Draw the springing line of the arch of the required span A B; divide this line into five equal parts, as numbered. With a radius equal to the span describe arcs intersecting at E, and from the intersection draw lines through each side of the central division. Then



Setting Out Five-centred Arch.

with a radius equal to three divisions draw arcs intersecting as shown, and from the intersection draw lines through the end of the next two divisions. The small circles show the centres for describing the five curves in the arch. Draw first from the centre C the curve at A up to the dotted line, then continue the curve from the centre F up to the next dotted line, and from E up to the next, then from G to the next, and from D to the finish.

Removing Gold Paint.—To remove gold paint, melt 3 parts of American potash and 1 part of unslaked lime in 10 parts of water. With this, paint the articles repeatedly by means of an old paint-brush until the gold paint softens, then wash in hot water with a sponge. Another method is to rub the surface well with benzine and a little finely powdered pumice-stone, and afterwards well wash with strong soda water. Care should be taken not to allow the first-named preparation to come in contact with the clothes or hands, as it is of a burning nature.

Restoring Colour of Mackintosh.—In the case of a black mackintosh having turned a greenish hue, the original colour can be restored in the following way. Make two solutions. For one solution boil 4 oz. of logwood chips with 1 pt. of water, strain, and make up to 1 pt. again, and add about 1 drachm of carbonate of ammonia. For the other solution, dissolve 2 oz. of sulphate of iron and ¼ oz. of sulphate of copper in 1 pt. of water. Having both solutions warm, sponge the mackintosh first with the logwood solution, and when it is nearly dry sponge with the sulphate of iron solution. A second treatment with the logwood solution following the iron solution may render the mackintosh blacker.

Storing Varnish in Barrels.—Varnish when stored in barrels should never be moved about, for the following reason. After standing a few days there falls to the bottom of the barrel a sediment which consists chiefly of particles of manganese driers and refuse of the gum, known in the trade as varnish foots. When this has settled, if the barrel is disturbed by shaking this sediment mixes with the varnish and turns it streaky and unfit for high-class work, as the varnish when applied over white or any delicate tints clearly shows the faulty varnish by brushing up in dirty irregular patches. The idea prevalent among users of varnish that unless the sediment be mixed into the varnish it loses its drying properties is quite a mistake, as the sediment is simply the spent drying agents and refuse from the gums used in the manufacture of the varnish. This sediment can only be removed by allowing the varnish to repose or by passing it through a filter press. A method of removing the varnish from barrels is to place or screw a treacle tap about 2 in. from the bottom of the barrel, so that the varnish will run clear of the foots, then place on a stand and allow to repose some time before using.

Lamp Shade.—Fig. 1 shows a lamp shade trimmed and Fig. 2 the frame. The stretchers will be 6½ in. long,

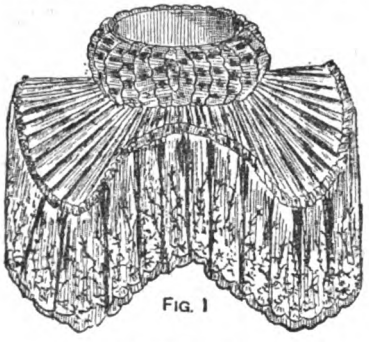


FIG. 1

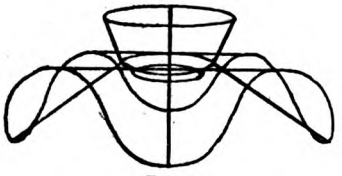


FIG. 2

Lamp Shade.

and the rim 5 ft. 4 in. For trimming, 3½ yds. of sateen silk, and the same quantity of lace, will be required.

Repairing Photograph Album.—For repairing or adding to albums it is not possible to buy papers already cut, as, owing to the many different sizes and positions of the openings, etc., it would be impossible to keep a stock. However, should the worker wish to cut the papers himself, the following hints may be useful. First procure some good white paper; a printing paper will be best, a useful size being demy, and of this about 24 lb. to the ream is a good quality. Cut up a number of sheets a little larger than the leaves of the album, and with one of the edges straight and smooth. Next make a template of sheet zinc of the size of the present openings in the album leaves; or if the openings are the ordinary cabinet or carte-de-visite sizes, procure glass cutting shapes from a dealer in photographic materials. Get also a large sheet of zinc or glass for cutting on. Take a sheet of paper and mark with a pencil the position of the opening, measuring with compasses from the back edge of the old paper and the top edge of the leaf, and making the marks on the new paper from the smooth edge already mentioned. Then place the template to the lines and, having the zinc or glass sheet below the paper, cut round the shape with a sharp knife. Go over the album leaves and tear away the old paper from the holes so as to expose the cardboard underneath, taking notice where the paper has been pasted to the board. After all has been made as smooth as possible, fasten on the new paper with flour paste of such consistency that it will work easily with a brush, pasting over the cardboard and taking care not to cover any part where paste had not been formerly. Now lay on a sheet of paper with the holes, placing the smooth edge close to the joint at the back of the leaf; over this lay a sheet of waste paper, and rub over the whole surface with the hand to ensure the new covering sticking to the leaf. All the leaves are treated in the same manner, and the album is closed up and put under a heavy weight or in a copying press until dry. The edges of the leaves must then be trimmed with scissors or a sharp knife.

Octagonal Table.—The wood of the octagonal table shown in elevation by Fig. 1 is all of ⅞-in. thickness, the

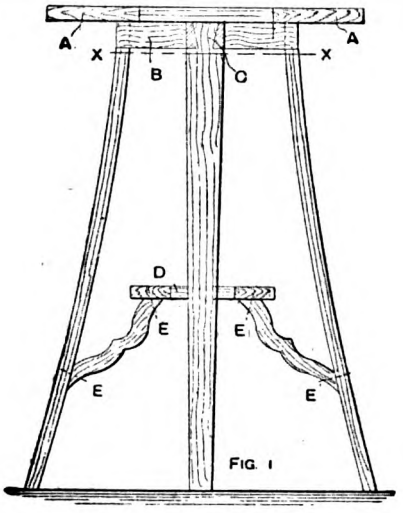


FIG. 1

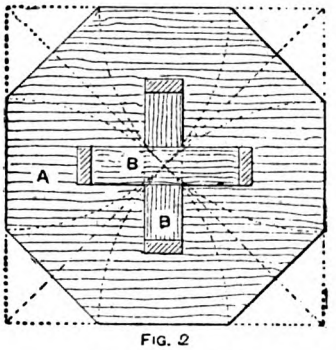


FIG. 2

Octagonal Table.

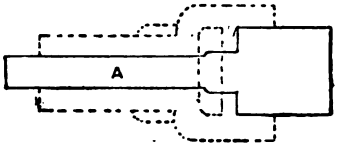
most suitable being oak or walnut. The top A (Figs. 1 and 2) is made from a piece 20 in. square, and the rails B, shown in plan in Fig. 2, which is a section on X X (Fig. 1), are 11 in. long by 1¼ in. broad, and are fastened together by a half-lap joint. On the ends of these rails dovetails C (Fig. 1) are cut, into which the legs fit. The top is held by screws, which go through the rails, and the octagonal tray D, which is cut from a piece 9 in. sq., should be placed about 12 in. from the bottom of the legs. It is held in position by screws E, which go through the two ends of each of the four supports or brackets. The edges of the top can be chamfered or rounded, or a moulding may be run on them, as desired. The four legs are 30 in. long by 2¼ in. broad, tapering to 1¼ in. The method of marking out the octagonal top is indicated by dotted lines in Fig. 2. The supports for the tray may be made 8 in. long by 1¼ in. broad, and the spread of the legs at the bottom may be 22 in.

Removing Mercury from Watch and Case.—Heat will drive off the mercury from the works and case of a silver watch, but cannot be applied to the movement without spoiling it. The movement will therefore have to remain as it is; no particular harm will be done. The case can be taken to pieces and the parts heated separately. It will then want well buffing with rottenstone and polishing with rouge.

Cream Paste for Calf Boots.—For a cream paste for calf box boots, procure 1 lb. of curd soap, 4½ pt. of water, 2 lb. of beeswax, 2 lb. of oil of turpentine, and colour as desired. Cut up the soap and dissolve it in water by boiling; then dissolve the wax in the turpentine by heating the two together, and slowly pour this into the soap solution, briskly stirring the mixture until it is cool and creamy. The above can be made into any colour by placing aniline dyes in the water before adding the soap.

Repairing Cracked Oven.—The cracking of a cast-iron oven often is brought about by the oven being screwed up or fixed too tightly so that there is no give-and-take to the movements of expansion and contraction. All good ranges now have wrought-iron ovens. Covering the crack with a plate of iron bedded with putty, then screwing on, will make a lasting job. If the crack is not easily got at, then a sound, if not good-looking, job can be made by plastering over the crack or fissure some fire-resisting cement such as Purimachos cement.

Hardening Bushes for Mail Patent Axles.—For hardening or chilling the inner face of a cast-iron bush for a mail patent axle, make the iron core or chill as shown by the accompanying sketch; do not make it exactly parallel, but slightly tapering, say $\frac{1}{16}$ in. in a foot. For forming the recess in the box that holds the oil, make a ring of sand to the size required, using a flat open core-box. Before



Hardening Bushes for Mail Patent Axles.

putting the iron core A in the mould, coat the core with hot tar, then place the ring of sand in position as shown by the dotted lines; place it in the mould ready for casting the box. When the metal has been run into the mould, it will be found that the coat of tar gives a certain amount of clearance to the iron core, so that it can be driven out without the risk of breaking the casting.

Tinting Paints and Colours.—The following list is useful when preparing tints and colours. As there is no standardisation of colour, the following proportions are given as made from the finest quality of paints and colours; where cheaper qualities are mixed the quantities of the ingredients should be varied to suit, and many who prefer to mix their own particular shade or colour, or who do not care to stock a large assortment of colours, will find it easy to compound whatever shade they require from the following comprehensive formulæ. *Whites:* Pure white, equal parts white-lead and zinc white; translucent white, white-lead 1 part, barytes 10 parts; flake white, pure English white-lead; Cremnitz white, pure zinc oxide 100 parts, ultramarine 1 part; permanent white, finest barytes 200 parts, blue 1 part; transparent white, oxide of zinc 1 part, barytes 20 parts; and clear white, white-lead 300 parts, ultramarine 1 part. *Yellows:* Primrose, pale zinc chrome; lemon, lemon chrome; buttercup, middle chrome; canary, white-lead 10 parts, lemon chrome 1 part; old gold, white-lead 6 parts, ochre 12 parts, middle chrome 3 parts; transparent yellow, yellow ochre 1 part, barytes 10 parts; golden ochre, yellow ochre 5 parts, lemon chrome 2 parts; cream tint, white-lead 100 parts, italian ochre 3 parts; light stone, white-lead 100 parts, yellow ochre 6 parts; middle stone, white-lead 100 parts, yellow ochre 12 parts; dark stone, white-lead 20 parts, yellow ochre 12 parts, raw umber 4 parts, venetian red 1 part; light oak, white-lead 6 parts, yellow ochre 6 parts, venetian red 2 parts, umber 1 part; dark oak, white-lead 2 parts, yellow ochre 3 parts, venetian red 1 part, umber 3 parts; buff colour, white-lead 100 parts, yellow ochre 7 parts, middle chrome 1 part; roman ochre, yellow ochre 50 parts, turkey umber 3 parts; ash colour, white-lead 50 parts, raw umber 5 parts, yellow ochre 1 part; maple colour, white-lead 100 parts, yellow ochre 3 parts, raw umber 1 part; amber colour, burnt umber 3 parts, middle chrome 3 parts, orange chrome 8 parts; copper colour, white-lead 100 parts, middle chrome 19 parts, venetian red, umber, and green, 3 parts each; leather colour, white-lead 20 parts, yellow ochre 5 parts, venetian red 2 parts; bronze yellow, white-lead 10 parts, lemon chrome 4 parts, raw umber 5 parts; golden yellow, middle chrome 16 parts, yellow ochre 1 part; italian yellow, yellow ochre 14 parts, burnt umber 1 part; hay colour, white-lead 100 parts, yellow ochre 4 parts, raw umber 4 parts, deep green 1 part; and limestone colour, white-lead 100 parts, yellow ochre 1 part, raw umber 1 part. *Reds:* Maroon, venetian red 2 parts, indian red 4 parts, lampblack 1 part; tuscan red, rose pink 2 parts, indian red 4 parts; light indian red, venetian red 1 part, indian red 3 parts; deep indian red, indian red 5 parts, lampblack 1 part; oriental red, rose madder 2 parts, orange lead 1 part; turkish red, pale vermilion 4 parts, mahogany lake 1 part; mauve tint, white-lead 6 parts, prussian blue 2 parts, madder red 1 part; violet tint, french ultramarine 14 parts, crimson lake 3 parts; lavender tint, white-lead 100 parts, ultramarine 3 parts, madder lake 1 part; lilac tint, white-lead 100 parts, ultramarine 1 part, rose madder 1 part; terracotta, white-lead 2 parts, venetian red 1 part, burnt sienna 1 part; salmon, white-lead 40 parts, golden ochre 5 parts, venetian red 1 part; bright orange, orange chrome 1 part, orange lead 2 parts; mahogany, orange chrome 10 parts, burnt sienna 3 parts, white-lead 1 part; brick colour, venetian red 2 parts, white-lead 1 part; rose tint, white-lead 16 parts, crimson madder 1 part; orange red, orange chrome; indian pink, white-lead 100 parts, indian red 3 parts, rose madder 1 part; light pink, white-lead 100 parts, rose madder 4 parts, vermilion 1 part; flesh colour, white-lead 50 parts, yellow ochre 2 parts, burnt sienna 1 part; purple tint, white-lead 1 part, ultramarine 1 part, indian red 1 part; and cherry red, rose madder 1 part, vermilion 2 parts. *Blues:* Pure blue, zinc white 20 parts, English ultramarine or cobalt blue 2 parts; sky blue, white-lead 300 parts, cobalt blue 1 part, prussian blue 1 part; misty blue, white-lead 50 parts, ultramarine 10 parts, burnt umber 1 part; opaque blue, zinc white 1 part, french ultramarine 1 part; sea blue, white-lead 16 parts, ultramarine 3 parts, raw sienna 2 parts; turquoise blue, white-lead 20 parts, ultramarine 2 parts, light green 1 part; deep blue, prussian or ultramarine blues; blue black, ivory black 40 parts, prussian blue 3 parts; royal blue, white-lead 1 part, ultramarine 15 parts; azure blue, white-lead 150 parts, prussian blue 1 part; oriental blue, white-lead 100 parts, prussian blue 9 parts, lemon chrome 1 part; greyish blue, white-lead 20 parts, prussian blue 2 parts, ivory black 1 part; and sapphire blue, zinc white 4 parts, chinese blue 1 part. *Greens:* Olive green, white-lead 12 parts, yellow ochre 4 parts, ivory black 1 part; sage green, white-lead 30 parts, light green 2 parts, burnt sienna 1 part; middle chrome green, lemon chrome 1 part, middle chrome 1 part, prussian blue 2 parts; pale emerald green, white-lead 2 parts, emerald green 1 part; sea green, white-lead 100 parts, deep green 4 parts; bottle green, light green 6 parts, lampblack 1 part; pea green, white-lead 100 parts, lemon chrome 1 part, light green 13 parts; oriental green, white-lead 2 parts, lemon chrome 2 parts, umber 1 part; blue green, deep green 7 parts, prussian blue 1 part; myrtle green, white-lead 20 parts, middle chrome 7 parts, ivory black 1 part; bronze green, middle chrome 2 parts, raw umber 5 parts, burnt sienna 1 part; pale green, zinc green 4 parts, zinc white 5 parts; grey green, terra verte 10 parts, raw umber 1 part, white-lead 1 part; citron green, white-lead 40 parts, middle chrome 3 parts, ivory black 1 part; and water green, white-lead 50 parts, deep green 2 parts, yellow ochre 10 parts. *Browns:* Golden brown, white-lead 20 parts, yellow ochre 3 parts, burnt sienna 1 part; snuff brown, white lead 9 parts, orange chrome 1 part, burnt umber 2 parts; foliage brown, vandyke brown 2 parts, burnt sienna 1 part; coffee brown, burnt umber 9 parts, yellow ochre 4 parts, venetian red 1 part; cocoanut brown, burnt umber 4 parts, yellow ochre 1 part, white-lead 1 part; amber brown, burnt umber 9 parts, middle chrome 5 parts, venetian red 3 parts; walnut brown, burnt umber 5 parts, raw sienna 1 part; italian brown, vandyke brown 4 parts, raw sienna 1 part; pale brown, white-lead 4 parts, burnt umber 1 part; stone brown, burnt umber 10 parts, golden ochre 1 part, burnt sienna 2 parts; deep fawn, white-lead 10 parts, burnt umber 4 parts, ochre 1 part; purple brown, indian red 8 parts, burnt umber 1 part, black 1 part; coach brown, indian red 5 parts, ivory black 2 parts; orange brown, burnt sienna 5 parts, orange chrome 4 parts; light drab, white-lead 50 parts, burnt umber 12 parts, ochre 1 part; deep drab, white-lead 20 parts, burnt umber 14 parts, ochre 2 parts; fawn tint, white-lead 60 parts, burnt umber 5 parts, yellow ochre 3 parts; light stone, white-lead 20 parts, italian ochre 1 part; tan colour, white-lead 20 parts, burnt umber 6 parts, burnt sienna 3 parts, and yellow ochre 2 parts. *Greys:* Pure grey, raw turkey umber 1 part, ivory black 1 part, white-lead 40 parts; light french grey, white-lead 200 parts, ivory black 2 parts, blue 1 part; pearl grey, white-lead 50 parts, venetian red 2 parts, deep green 2 parts; dove grey, white-lead 50 parts, ultramarine blue 4 parts, ivory black 1 part; lead colour, white-lead 100 parts, ivory black 8 parts; and slate colour, white-lead 100 parts, ivory black 3 parts, ultramarine 1 part. *Blacks:* Purple black, lampblack 5 parts, rose pink 1 part; blue black, ivory black 20 parts, prussian blue 3 parts; jet black, ivory black 10 parts, umber 1 part, prussian blue 1 part; and olive black, vine black 20 parts, yellow ochre 1 part.

Wax Moulds for Plaster Casts.—Wax moulds are made from equal parts of pure beeswax and powdered resin. With wax of very good quality the proportion of resin may be doubled. A poor wax will be improved by the addition of a little tallow. The mixture should be slowly melted over the fire, and allowed to become slightly cool before using. The safest way is to melt the wax and resin in the same manner as glue is melted, that is, by placing them in a jar or pot surrounded with boiling water. For taking a mould from a plaster original, the plaster is well saturated with water to prevent the wax sticking. When as much moisture as the plaster can contain has been absorbed, the surplus water on the surface of the plaster should be wiped off with a sponge, and the wax carefully poured over. The plaster need not be coated with shellac, but, if soaking in water is objected to, a coat of paraffin oil in which a little white wax or stearine has been melted can be applied.

Portière Rod.—In Series I., pp. 125 and 145, are two designs showing how to fix up a portière rod, and the following is a description of another portière rod device (Fig. 1). It works with the door, backwards and forwards as the door is opened or closed, and consists of a bracket (Fig. 2) cut out of mahogany 1 in. thick, 3 in. wide at the top, and 6 in. long, and screwed to the moulding on the door frame, hanging side. A piece of iron is bent to shape (Fig. 3), and is screwed

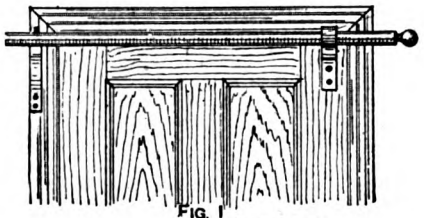


FIG. 1

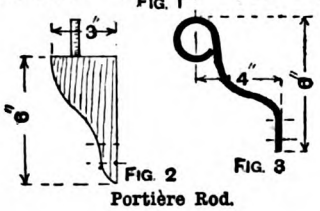


FIG. 2 FIG. 3

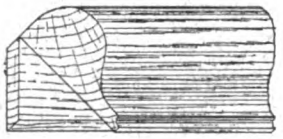
Portière Rod.

to the door 2 in. from the shutting stile. A rod of wood, bamboo, or iron is cut 3 in. longer than the distance between the outside of the mouldings, and a hole is bored with a red-hot nail in the case of the wood or bamboo, or drilled for iron at 1½ in. from one end. In it works a screw, with the head filed off; this screw is fastened in the top of the bracket. The curtain is hung on rings, the two end ones being fastened to the rod by wires going through or round the rod to prevent them falling off in working.

Holes in Plaster Cast.—These are caused by bad casting. Only a small quantity of gauged plaster should be poured into the mould to begin with, and this should be sufficiently liquid to be shaken or blown into the smallest markings. When filling up any of these air holes the spot should be soaked with water before applying the fresh plaster. If this is not done the cast will absorb the moisture from the newly applied plaster, preventing its proper setting and rendering it liable to crumble away.

Cycle Transfers.—The usual method of making transfers for cycles is by the lithographic process, and bronze powder is used. The design is drawn and put on the stone; sometimes a number of stones will be necessary to complete the design, as each colour must have a separate stone; when bronze enters into the design, this is printed first. The design is rolled over with varnish instead of ink, and an impression taken on paper which is dusted over with bronze. The bronze sticks to the varnished impression and the surplus is wiped off, leaving the impression as solid as if it had been done with gold leaf. The design may be finished with this one printing, or other colours may be added. If a large number of transfers are required, it is usual to print several on one sheet of paper at a time and cut them up afterwards with a shaped cutter, which is simply a steel punch taking the conformation of the design. These transfers are printed on a thin paper which is afterwards coated with a special mucilage. A cover paper is also gummed over the printed sheet to protect the design. When applying the transfers to the cycles, the thin paper is damped and placed in position and rubbed gently but firmly to ensure the transfer adhering. After this is dry the cover paper is damped, and if properly done it will slip or peel off, leaving the transfer in position on the article.

Cramping up Mitred Picture-frame Joints.—For cramping up a picture-frame which has halved and mitred joints (see Fig. 1) a simple apparatus is shown in plan and perspective by Figs. 2 and 3 respectively. Cut out a piece of wood as B, taking care to have the angle as near a right angle as possible, and screw this to a base piece A. Prepare a piece of wood as C; for many cases it will be better for this to be rebated as shown by dotted lines in Fig. 3, so that it may fit into the rebate of the frame. Now take a third piece, which should be of hard



Cramping up Mitred Picture-frame Joints.

FIG. 1

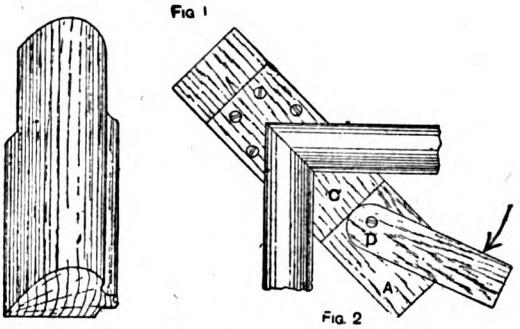


FIG. 2

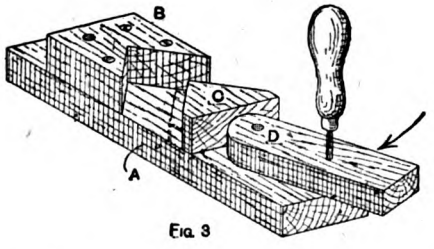
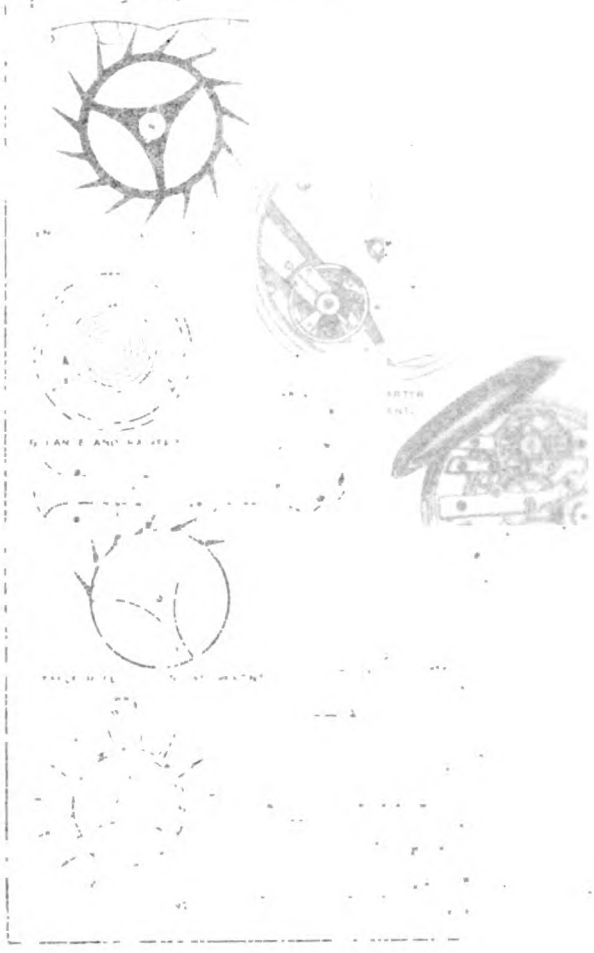


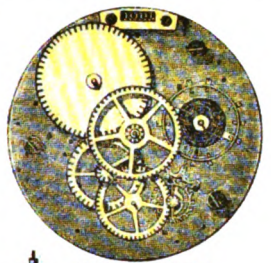
FIG. 3

wood, and round one end as D. Make a hole in the centre of the round and insert a screw in the base piece. It will be noticed that when the frame is adjusted, and C and D are placed in position, as indicated by the arrow, the frame will hold two parts of the joint tightly together. To prevent D springing back, a bradawl should be inserted as shown in the illustration. By simply altering the position of the screw of D, the apparatus can be made to suit varying sizes of mouldings. After the glue in the joint has become hard, the joint may be further secured by a screw from the back.

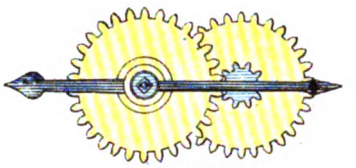
Acid for Testing Alkali.—For determining the strength of alkali employed in starch manufacture decinormal sulphuric acid is used; it is shortly described as $\frac{N}{10}$ acid, and contains 4·9 grammes of real sulphuric acid in 1 litre; 1 c.c. of this acid = ·0049 gramme sulphuric acid, and also = ·004 gramme of caustic soda. To prepare the acid, 30 c.c. of the concentrated acid are diluted to 1 litre with distilled water, to form an approximately normal solution; a measured portion (say 10 c.c.) of this acid is precipitated by barium chloride, the barium sulphate produced is washed, collected, dried, ignited, and weighed, and from its weight the amount of sulphuric acid in the diluted acid can be calculated. The decinormal acid may then be made from this acid by diluting it until it is strictly normal, and then diluting this normal acid 1 in 10—that is, 1 part of acid to 9 parts of water.



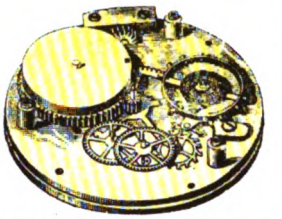
MECHANISM OF WATCHES.



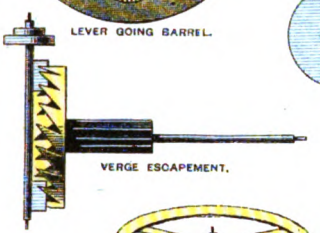
LEVER GOING BARREL.



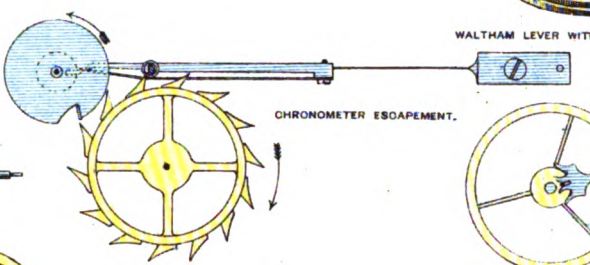
MOTION WORK.



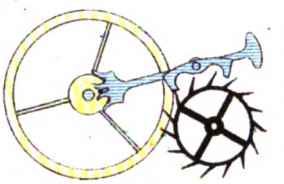
WALTHAM LEVER WITH TOP PLATE REMOVED.



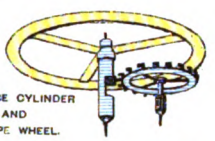
VERGE ESCAPEMENT.



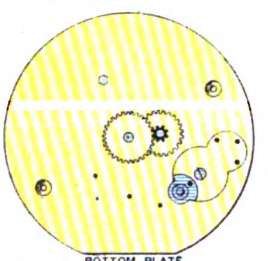
CHRONOMETER ESCAPEMENT.



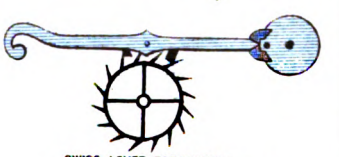
LEVER ESCAPEMENT



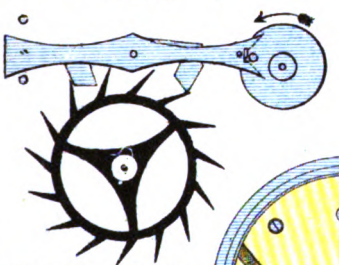
BALANCE CYLINDER
AND
ESCAPE WHEEL.



BOTTOM PLATE
SHOWING
MOTION WORK.

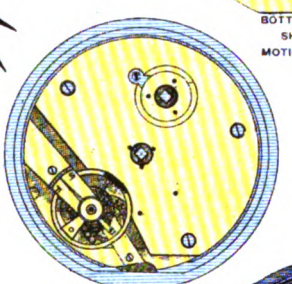


SWISS LEVER ESCAPEMENT.

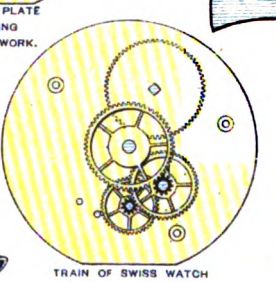


ENGLISH LEVER ESCAPEMENT.

RACK LEVER.

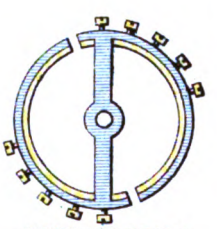


SWISS THREE-QUARTER
PLATE MOVEMENT.



TRAIN OF SWISS WATCH

BALANCE AND HAIRSPRING.



COMPENSATION BALANCE.

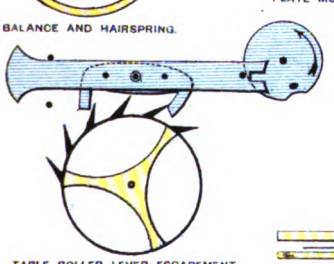
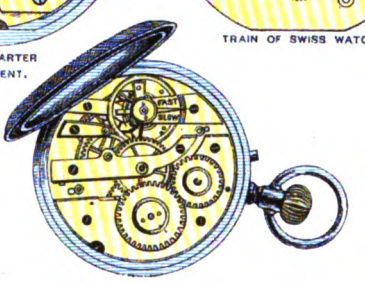
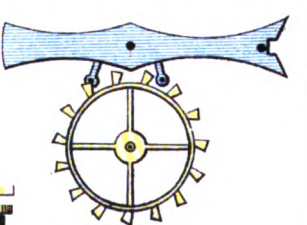


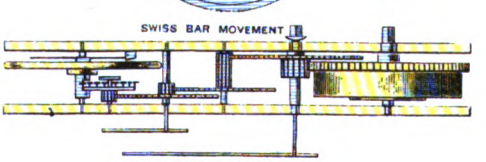
TABLE ROLLER LEVER ESCAPEMENT.



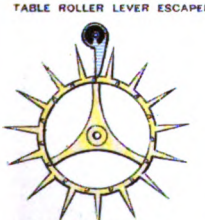
SWISS BAR MOVEMENT.



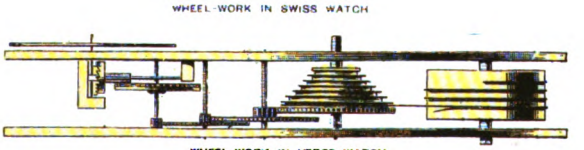
PIN LEVER.



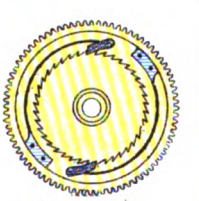
WHEEL-WORK IN SWISS WATCH



DUPLEX ESCAPEMENT.



WHEEL-WORK IN VERGE WATCH.



FUSEE CLICKWORK.

Removing Lime Deposit from Iron Pipes.—There is no practical way of removing lime deposit from iron pipes, and with boilers all that can be done is to open them and chip out the lime with a chisel. It has been stated that making the pipes red-hot and hammering them will loosen the scale, but to do this they must be taken out, and in the end new clean pipes would cost no more. There are "boiler fluids" sold which, when boiled up in the boilers and pipes, soften the deposit, but do not remove it; it must be scraped out. The only practical recourse is to put new pipes in, and the larger they are the longer they will go without renewing.

Blackboard.—Figs. 1 to 3 show the construction of a clamped blackboard. The material generally used is best pine, free from knots and with a close grain, the usual thickness in the rough being about 1 in., which works down when finished to about $\frac{7}{8}$ in. The board would have to be formed by jointing up two, three, or more 11-in. boards, depending, of course, upon the particular size required. The best job results if these joints are ploughed and a cross tongue is inserted, all the joints being glued, of course. When the glue

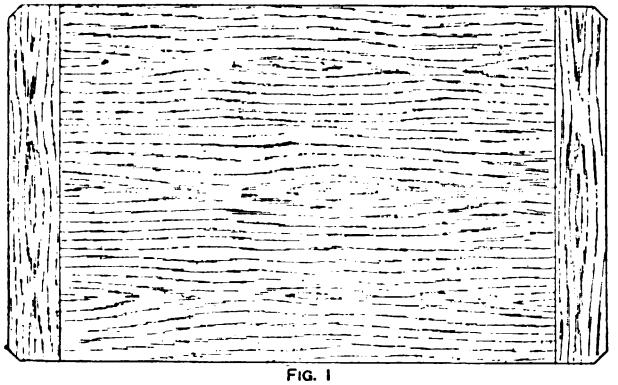


FIG. 1

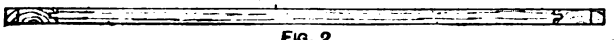


FIG. 2

Blackboard FIG. 3

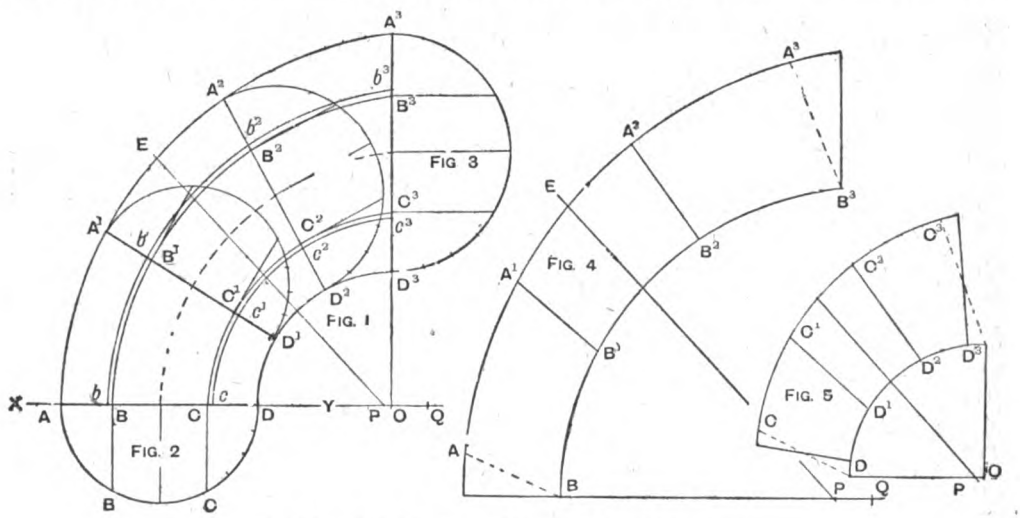
becomes hard, prepare the clamps. These are usually about 3 in. wide. Then tenons and haunchings at each end of the board should be set out and made, after which the mortises in the clamps should be made and the inner edges ploughed to receive the haunching (see Fig. 3). Next glue the mortises and tenons and fix the clamps by wedging the mortises and tenons together, after which each surface should be planed off true and smooth.

Hardening Clock Pinions.—Clock pinions may be made of mild steel and case-hardened, preserving the bright surfaces by packing them in a box with the hardening material, and cooling without contact with the air. But this process will not ensure that they keep straight and true any more than making them of cast steel and hardening them in the ordinary way will. It is only constant practice that enables a workman to harden a pinion and keep it true, and nearly all pinions go a little out and have to be straightened by hammering. After hardening, each pinion requires trueing separately.

Barrel for Three-octave Street Organ.—The length of a barrel for a three-octave organ will depend on the number and spacing of the levers to be lifted. The length of the tune will suggest the circumference of the barrel, but it should be as large as possible, as, unless a sideways movement is given to the barrel, the tune is played in one revolution of the barrel. If two or more tunes are on one barrel, they should be about the same length, as the same mechanism that turns the barrel also works the bellows. There should be a small space unpinned so that the organ is supplied with wind before any of the pipes are expected to sound. The barrels are made of 1-in. pine, strips of which are joined together on a pair of octagonal ends, which may be made of well-seasoned mahogany, and on these ends the axles or pivots are fixed. The joints of the strips must be good and well glued, and the whole is then turned in a lathe to a true cylinder and covered with cartridge or drawing-paper. If the barrel is put in place and made to turn round, the ends of the levers which come in contact with the pins can be made to trace lines round the barrel, giving the lines on which the pins will be placed. Suppose the tune has sixty-four bars of music, then the barrel will have its circumference divided into, say, sixty-six parts, on two of which there are no pins. Each bar will be divided into parts according to the music. The best way to do this will be to set out on a band of paper 1 in. wide what may be called the time scheme of the tune; make the bars equal, and glue the ends together. Turn a disc of wood, mount the strip of paper on the edge, temporarily fix this on the barrel, and the time may be divided by moving the barrel through the same space. The time disc may be used many times with paper divided according to the requirements of each tune. The use of a lathe with a divided headstock will be better than the disc. Pins are used for short notes, but long notes require staples, the length of the middle part of which depends on the length of the notes. If a minim requires $\frac{1}{4}$ in., a semibreve will require $\frac{1}{2}$ in., and so on. To put two or more tunes on one barrel requires an arrangement by which the barrel is shifted so that the pins do not come in contact with the levers, and the barrel can then be set out again as before. On the axle will be cut a groove parallel with the axis, so that the sliding can only take place at the end of a tune. The unpinned space will then be under the levers, and sliding motion can be made without injury to the pins.

Spongy Brass Castings.—Spongy castings are probably caused by lack of finish in the moulds. Make the moulds in the usual manner with the moulding sand well rammed down. A quantity of new red sand should, however, preferably be mixed with the ordinary sand because old sand does not hold together so well as new sand. See that the two faces of the mould (that is, the she side and the peg side) are well dusted with facing sand, consisting of flour charcoal mixed with one-tenth its volume of fine sand, and also that the outside of the two faces are covered with parting sand so that the moulds may be placed together without fracture. This parting sand may consist of powdered firebrick waste. When the moulds are ready they must be allowed to stand against the core stove to dry, otherwise blow-holes will be caused by the steam evolved when the hot metal comes in contact with the damp sand. Experience alone can enable the operator to decide when the metal is at the right heat for casting; as a matter of preference, the metal should be too hot rather than too cold, although too great a heat is undesirable. Cover the metal with a little flour charcoal. Half new metal should be used in each heat so as to keep a uniform working alloy. If the furnace is pulling too fiercely the draught must be restricted, otherwise the metal will lose a considerable amount of its zinc, as this metal volatalises when heated much above its melting point.

Setting Out Pattern for Pipe Bend in Six Pieces.—When working patterns for pipe bends to be made in six pieces, it should be understood that the methods adopted give only a very near approximation to absolute accuracy, as, owing to the amount of hammering the metal has to undergo, the stretching and tucking when hollowing vary with the quality of metal used, its thickness, and also the method adopted for working it. Commence by drawing the side elevation (Fig. 1) to the desired size, then draw the semicircles representing the half plans or sections of the base and mouth (Figs. 2 and 3). Next divide the throat curve (Fig. 1) into three equal parts, as D, D^1, etc., and also divide the outside curve A A^3 similarly. Join A^1 D^1 and A^2 D^2. Find the centre of each of these lines and draw the semicircles shown, and it will be near enough for all practical purposes to assume that these semicircles are half the true shape of the section on their respective lines. Now divide each semicircle into three equal parts, and from each division point draw lines at right angles to each section line. To join each section line at the points B C, B^1 C^1, B^2 C^2, B^3 C^3, draw a curve through the points just mentioned as shown, and the two curves formed would represent the seams on the side of the bend. Next bisect D^1 D^2 on the throat of the bend, and also A^1 A^2 on the outside curve similarly; draw a straight line through the division points found, and produce it to join the ground line at P. Work the pattern for the centre piece B C, B^3 C^3 first, and to do this divide one-third of each semicircle into four equal parts. Take two divisions from the small semicircle at the base, and set these off on each side of the centre line of the base (Fig. 1) to give the points, *b c*; take divisions from the semicircles at A^1, A^2, A^3 and set off similarly to give the points b^1 b^2 b^3, c^1 c^2 c^3; curves drawn through these points would be the side pattern. To draw the top pattern (Fig. 4), first reproduce the curve B B^3 with the division points B^1 B^2 in position upon it, take the distance Q P from the ground line (Fig. 1) and set off from Q (the centre of the lower curve, Fig. 4) as Q P (Fig. 4). Bisect the distance B^1 B^2 (Fig. 4), and a line drawn from P through this division point would be one drawn at the same angle on the pattern as the line drawn from P on the elevation. Take a length slightly less than b^2 c^2 (Fig. 1) and set off from the curve on the centre line of the pattern (Fig. 4) to give the point E; take E A^1 from the elevation and set it off on each side of E, then with the length b^1 c^1 from the elevation and B^1 on the pattern as centre, cut the arc first drawn to give the point A^1. Take b^2 c^2 from the elevation, and B^2 on the pattern as centre, and cut the arc drawn to give the point A^2. Take the division A^2 A^3 on the elevation as radius, and with A^2 on the pattern as centre draw an arc; with b^3 c^3 from the elevation as radius and B^3 on the pattern as centre, cut the arc drawn to give the point A^3. Transfer A^1 A to the lower end of the pattern similarly, using *b c* from the elevation as radius, and B on the pattern as centre, to obtain the point A. Join A B and A^3 B^3, and draw an arc through A A^1 A^2 A^3 to form the pattern. When hollowing this pattern the outer curve would shrink in length, and allowance is made for this by the length beyond the points A and A^3, the point marking the allowance on the curve being joined to B and B^1 respectively. For the throat pattern, reproduce the throat curve D D^3 to start the pattern (Fig. 5). Place the division points D^1, D^2 and also the centre point upon it, then work in precisely the same manner as for the pattern (Fig. 4), using the lengths from the elevation C C^1 C^2 C^3 to obtain the points on the outer curve. Then join C D and C^3 D^3. In this pattern the throat curve would be lengthened, and the outer curve slightly diminished in length in the working, and allowance is made for this at each end of the pattern by the line drawn as shown.



Setting Out Pattern for Pipe Bend in Six Pieces.

Harness Dressing.—The following is a recipe for a black dressing for harness, to be applied with a sponge. Mix together molasses 8 parts, lampblack 1 part, sweet oil 1 part, gum arabic 1 part, isinglass 1 part, and water 32 parts, all by weight. When cold, add 1 oz. of spirit of wine. If the preparation is hard when being used, place the vessel containing it in hot water to get thoroughly warm. In warm weather this is not necessary. Add 1 pt. of turpentine after all the other ingredients are well mixed, but before putting in the spirit of wine.

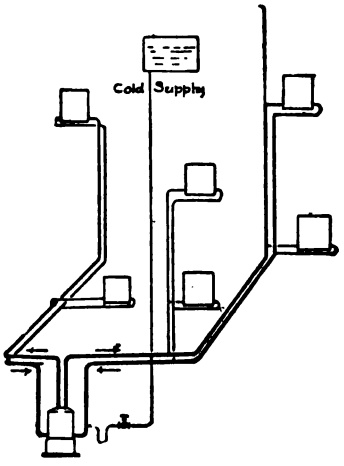
Removing Paint and Varnish.—The following are for removing old paint and varnish. (1) Dissolve 3 lb. of caustic soda in ½ gal. of water, then stir into it 2 lb. of quicklime. Sufficient silicate of soda or waterglass should now be added to form a paste. (2) Dissolve in an earthenware jar equal parts of soda crystals and quicklime in water, then add sufficient flour to form a paste. (3) Mix together in a stone bottle equal parts of spirit of wine and turpentine, then add a small quantity of carbonate of potash and stir well. Rub the varnish by means of an old piece of rag, afterwards washing down with soapy water. Finally, rinse down with cold water. The two first-named preparations should be rubbed over the work by means of an old paint-brush, and allowed to remain until the paint softens, when it may easily be removed by means of a knife, or by scrubbing with cold water. These preparations burn; they should not be touched with the hands.

Colouring Tiles.—For colouring brown roofing tiles a permanent dark grey the following preparation is found to make an excellent covering; it is not affected by atmospheric influences, and is quite waterproof when hard. Dissolve 9 lb. of casein and 2 lb. of borax in 2 gal. of boiling water, then stir in 4 lb. of newly slaked lime, afterwards adding sufficient finely powdered whiting to form a wash or paint. The wash or paint should then be tinted to the required shade of grey by adding in variable proportions lime blue, lampblack, and umber. Apply two coats with a whitewash or distemper brush. A little boiled oil may be added to make the wash adhere more firmly. Even in exposed places this wash will last for a considerable time. A cheaper wash, but not such a reliable one, is made by mixing any quantity of glue size and water, and add to it 4 parts of slaked lime and 6 parts Portland cement. Colour in the manner already described, and add a little boiled oil.

Solvent for Gelatine.—To dissolve gelatine in a fluid that will evaporate quickly, use the following method. Place 1 oz. of gelatine in a wide-mouthed bottle, add 2 oz. of water, and place aside for twenty-four hours, when the water will be absorbed and the gelatine will have swollen up. Place the bottle in a pan containing a little cold water, and heat up gradually to boiling point; when the gelatine is hot, remove the bottle, and add methylated spirit very gradually, stirring well in. The methylated spirit should be added very carefully, as too much of it will precipitate the glue and render it stringy and tough. The mixture may be made more fluid, if desired, by first adding water and afterwards spirit, keeping to the proportions found best in the first trial.

Hardening Glycerine.—Glycerine may be hardened by mixing it with its own volume of water and then making it into a paste with plaster-of-Paris. It is also stated that glycerine may be hardened by mixing it to a paste with litharge.

Hot-water System.—Among the hot-water systems of heating buildings are the one-pipe, two-pipe, and overhead systems, and there are modifications of each of these systems. The high-pressure system is another method, but in this case a coil is fixed in the furnace and a boiler is not used. The accompanying illustration shows a typical two-pipe low pressure apparatus in which the



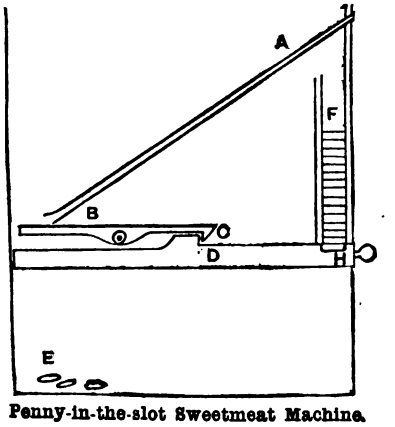
Hot-water System.

heat is distributed by radiators. In certain buildings large pipes are used as a heat radiating surface. With the apparatus here shown, one or more flow pipes proceed from the top of the boiler and take a convenient course to reach the radiators, having a gentle rise all the way. The return pipes are usually run close beneath the flow pipes, as shown. The radiators are on branches from the two pipes, as indicated. The circulatory movement of the water is in the direction of the arrows. From one of the high points of the apparatus a steam pipe is taken, terminating at some point above the level of the cold-water cistern. The cold supply is a pipe coming direct from a cold cistern down to the boiler, either entering the boiler at a low point or joining a return pipe close to the boiler. The cold cistern may be that which supplies the whole building with water; but should the highest radiator be two or three floors below this cistern, then a convenient and desirable arrangement may be the placing of a small intermediate cistern just above the level of the highest radiator, and feeding from that cistern. Sometimes the intermediate cisterns are hand-fed, sometimes they have water laid on, with a ball valve.

Preparing Brickwork for Signwriting.—Any small defects or cavities in the brickwork should be filled with the oil cement described below, which dries hard like flint in a few hours, and will not crack or fall from the walls. Mix together into a paste with boiled oil 7 lb. of clean sharp sand, 2 lb. of slaked lime, 2 lb. of litharge (powdered); rub the holes with raw oil and use the paste as a mortar. After the paste has thoroughly hardened, apply a coat of raw oil over the wall that is to be painted, rubbing well into the brickwork until all suction is stopped; then apply a coat of genuine white-lead mixed with equal parts of raw and boiled oil and turpentine 1 part, with a little patent driers; a little black paint may be added if the ground coat is to be of a dark colour. The work may then proceed in the usual manner. That the priming coats should be built up and prepared from the best materials and with the utmost care is a matter of great importance, for on this careful preparation the durability of the subsequent coats of paint depends. The walls should be perfectly dry before the work is commenced, and each coat of paint should be allowed to dry hard before the next coat is applied.

Cement for Felt and Cork.—For fixing a felt and cork covering with a cement that is pliable and can withstand reasonable heat and dampness, shoemakers' paste can be used, or a thick flour paste (as used by paperhangers for hanging heavy papers) to which has been added one-third its bulk of freshly made glue, may also be used. The following recipe can also be recommended. Clear gum arabic 8 oz., fine starch 6 oz., white sugar 4 oz.; pulverise and dissolve the gum in 1½ pt. water, mix the starch and sugar in the gum solution, then boil the whole in a vessel suspended in boiling water (glue-pot fashion), stirring and cooking till the mixture becomes clear and of the consistency of thick gum. A lump of camphor or a few drops of oil of cloves may be added to serve as a preservative and also to impart a pleasant odour.

Penny-in-the-slot Sweetmeat Machine.—The illustration shows one of the simplest penny-in-the-slot arrangements in use. The sweets are stored at F; a hollow H in the drawer D enables the bottom packet to be drawn out. The drawer is locked by the catch C on the



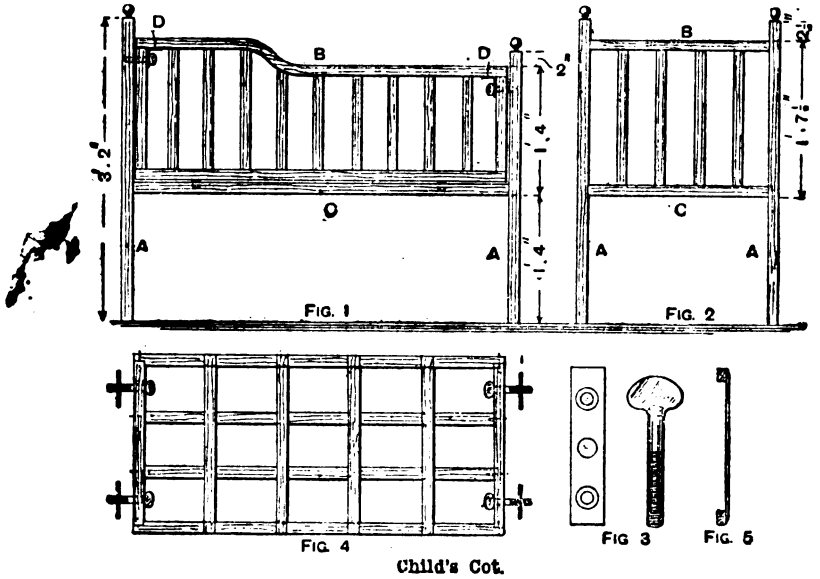
Penny-in-the-slot Sweetmeat Machine.

trigger B. To unlock the drawer, a coin is passed down the shute A, and, its weight resting on the trigger B, lifts it. The drawer can then be pulled out. This allows the trigger B to fall still farther, and the coin drops into the till E. The shute A should be made to take the coin exactly, and the trigger B to require the exact weight of the coin to release the drawer. This makes fraud more difficult.

Photographic Carbon Transparencies.—The carbon process is certainly the most beautiful of all methods of photographic printing. The objection to the single transfer process is that the image is reversed. This is of little account with many outdoor scenes, and still less in the case of a transparency that may be viewed from either side, such as when the views on glass are to form panels in a window. The colour chosen for a picture is a matter for individual taste, but a warm sepia is very good. To make the transparency, coat the glass with a 10 per cent. solution of gelatine and immerse in the bichromate bath (a 3 per cent. solution of potassium bichromate); dry, and expose to the light freely. Expose the carbon tissue under the negative (which must be safe edged) for the time indicated by the guide negative or by an actinometer. Now immerse glass and tissue in cold water until the tissue straightens itself, then bring both films in contact under water, remove, adjust in position on the glass, and stroke into close contact with a flat rubber squeegee. When partially dry, place in warm water, and as soon as the gelatine commences to ooze out at the edges, strip off the first paper, leaving the bulk of the tissue on the glass. Lave with the warm water until the correct density has been obtained, then rinse and immerse for a few minutes in a saturated solution of alum, and finally wash for half an hour. A specially heavy tissue is made for transparencies, and this should be printed rather deeper than usual.

Tar for Wood Outbuildings.—Coal tar gives far better results on wood than Stockholm tar, as it dries harder and is more durable if mixed properly. The following makes a good tar varnish, and is an excellent preservative for wood. Coal-tar pitch 3 lb., coal tar ½ lb., boiled oil ½ lb., coal-tar naphtha 1½ gal., and paraffin oil 1½ gal. Melt the pitch, then mix in the tar and oil; remove the mixture well away from fire, and allow to cool somewhat, then add, while constantly stirring, the paraffin oil, following with the naphtha. This preparation dries hard and glossy in about six hours, and costs only a trifling sum per gallon.

Child's Cot.—Figs. 1 and 2 illustrate a simple and inexpensive cot 4 ft. 2 in. long and 2 ft. 1 in. wide; it may be made of ordinary pine or, if preferred, in hard wood. The four corner posts A are 1½ in. square, all the top rails B are 1½ in. wide by ½ in. thick, and the bottom rails C are 1½ in. square. The ends, sides, and bottom are made separate for convenience when not in use. The side rests on the bottom, two screws being put underneath and holes bored in the bottom for them. Then the screw plates (Fig. 3) are let in the corner pillars in the top corners, and the whole, when screwed up, is very



Child's Cot.

firm. All the uprights are ½ in. wide by ½ in. thick. Fig. 4 illustrates the bottom. The outside framing is 1½ in. by ½ in., and the laths are 1½ in. by ½ in.; the two long ones are stump-tenoned into the outside frame and screwed through. The others are lapped into the top of the frame. Fig 5 shows the method of fixing the upright. The bottom is fixed with four of the screws and plates (Fig. 3), which are tapped ¼ in. When finished, give the cot two or three coats of paint (French grey looks well), screw four brass knobs on the posts, and castors on the bottoms if desired.

Gilding on Glass.—In writing on glass, the first consideration is that the glass must be cleaned thoroughly from all grease and dirt, and then polished with a little French chalk or whiting. Whatever design is to go upon the glass must be reversed, as the gilding is done upon the back of the glass. The size is made from a small quantity of isinglass dissolved in boiling water, carefully strained, and a little spirit of wine added to it. It is impossible to give the quantity of isinglass required, but when made it is well to try the size upon a piece of glass. If it works sluggishly or does not look clear, it is too strong, and should be weakened by the addition of water. If too weak, it does not bind the gold sufficiently to the glass, and the brush passing over the gold to fix it will partly destroy the effect. The size is flowed on the glass from a wide sable or camel-hair brush, and the gold is placed on the fluid size. It must be laid with a gilder's tip and cushion, and cannot be worked directly from the book, as it is done on japan size. When the size has dried, the glass may be lifted up and the face carefully looked over, and if the gold has not covered all the letters or ornament, the weak places must be gone over lightly with the size, and gold laid on where necessary. When dry, the gold may be rubbed over with a hare's foot or pad of cotton-wool. The brilliancy of the gold is increased if hot water is poured over it, the water burnishing it as it flows. Places where the gold is to remain must be carefully gone over with a writer's pencil, and any colour mixed with varnish and japanner's gold size of a consistency that can be easily worked. When the work has attained sufficient hardness it can be trimmed up with the point of a penknife, guided by the edge of a lath or straightedge, the whole carefully cleaned with water, and the background painted any colour that may be desired.

Soling and Heeling Riveted Boots.—Riveted boots to be repaired should first be put into a flat vessel of water for about fifteen minutes, in such a manner that the water does not reach the uppers. On taking out at the expiration of this time, do not immediately remove the old leather from the under leather, but allow the boots to dry slightly. When judged ready for removal, place the boots on an iron last and prise up the old leather, commencing at the toe, with a small chisel; the portion thus separated can then be seized with a pair of pincers and peeled gradually away, care being taken to press down the under leather with one hand, while pulling the remains of the outer with the other, to prevent the entire sole being pulled away from the uppers. In some cases it is next to impossible to prevent some parts of the under leather being pulled loose; securely rivet these before proceeding. Clear the under sole of loose nails, etc., placing small patches over any holes or much-worn portions, these being held in position by the new leather sole. The new leather must first be soaked in water, afterwards dried, and beaten evenly on a flat iron with a hammer. When thoroughly dry, and made supple by the beating, cut the leather roughly to the shape of the boot and attach it to the under leather with four rivets, one on each side, one near the toe, and one under the ball of the foot. Pare away the leather towards the waist of the boot with a sharp knife, or the leather may be filed down with a coarse rasp. Mark out a line round the sole, about ¼ in. from the edge, to show where the line of rivets should run, make the holes with a pointed awl, and rivet the sole securely. Pare away the rough edge of the new sole, leaving as broad a welt as may be desired. Now rasp all over the completed sole to get an even surface, working from the waist towards the toe; afterwards sandpaper to obtain a smooth surface. Heel-ball must be rubbed round the edges to blacken them, and these smoothed out with a warm iron. A gloss to finish is obtained by rubbing from toe to waist with a cloth over the thumb. The heel is renewed in exactly the same manner as the sole, the rasping being done from the waist outwards. The tools required are an iron last, an awl, a shoe-maker's knife, hammer, rasp, and glazing iron, the whole costing some few shillings. The leather for a pair of soles and heels costs from ninepence, this being the best leather, of English tannage; and ½-in. rivets, brass for the sole, iron for the heel, cost about one penny.

Casting Metal Bust.—Obtain a brass mould of the bust desired in two parts; let these be smooth and well finished. Before casting, the moulds must be heated nearly to the temperature of the metal being used. Well black the two parts of the mould with a mixture of lampblack and turpentine, and fix together. Run the melted alloy into the mould till it is nearly full, and when a sufficient thickness of metal has solidified, rapidly turn the mould over and allow the still liquid metal to run out. The inside of the mould may be burnished to remove roughnesses if desired. On taking the mould apart the figure will be found smooth and fine in detail. The best alloy to use consists of about 91 parts of tin to 9 parts of antimony. After a little practice these castings can be turned out rapidly. If necessary (which will easily be seen after casting a few busts) add to the alloy a little bismuth, not exceeding 1 per cent. This increases the fluidity of the metal. The busts can be finished under the polishing bob.

Cramping up Boards.—Fig. 1 illustrates a satisfactory method of cramping up glued and jointed boards by means of rope and blocks. The wood blocks A, about 4 in. long and 1½ in. square, are placed on the edges of the boards B, and a rope is passed round them twice and knotted. A small piece of wood is then placed between the two strands of rope and twisted round. This twisting draws the rope tighter on the blocks, thereby cramping the boards together. Three of these sets would be sufficient to cramp the boards. A more serviceable cramp is illustrated by Fig. 2. A piece of wood A, about 2 ft. 9 in. long, 6 in. wide, by 1 in. thick, is planed up. On each end of this are fixed blocks B, 6 in. long, 1 in. thick, and tapering in width from 4 in. to 2 in. The boards E to be cramped are placed on the appliance, pieces D are laid against the edges of the boards to protect them, and the wedges C are then driven home. These wedges should be about 10 in. long, 1 in. thick, and tapering in width from 4 in. to 1½ in. The whole of this device should be made of hardwood, except the packing pieces D, which should be deal, so that if too much pressure is applied to the wedges, any injury to the edges will be taken by the packing pieces rather than by the boards.

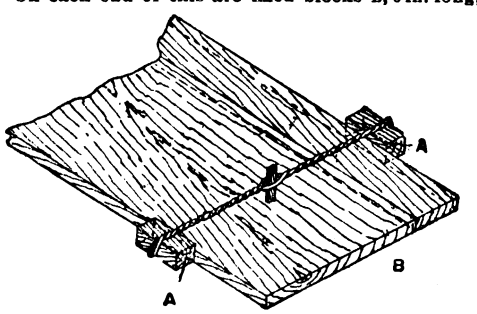


FIG. 1

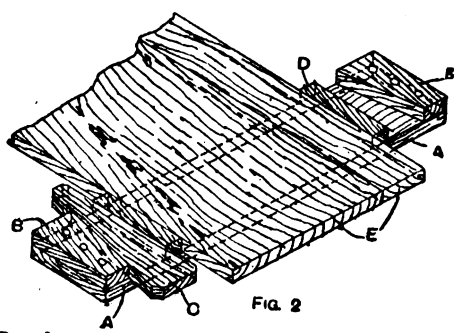


FIG. 2

Cramping up Boards.

Wire-winding 12-in. Naval Gun.—It has been found that 126 miles, or 14 tons 15 cwt., is the amount of wire wound on a 12-in. naval gun. With regard to wire winding, gunmakers contend that when the explosion—consequent on firing a shell—occurs in the powder chamber, the tubes are allowed to expand sufficiently without bursting; further, a higher velocity and greater range can be obtained. The steel wire used is hardened and tempered and very accurately drawn, its section being ·06 in. by ·25 in. For splicing the wire a couple of hanks, each weighing about 2 cwt., are taken. One end of each is placed in a milling machine, the table rest of which is tilted to give a taper of ·06 in. in 12 in.; thus the wire is tapered to the thickness of fine tissue paper. After being milled the ends are reversed, placed together, and soldered ready for drilling. Twenty-six holes ¼ in. in diameter are drilled between the two ends, after which steel rivets are driven in, and the wire is drawfiled to thickness and breadth gauges. A ton of wire is thus jointed and is wound on to an iron drum, which revolves between a pair of pedestals on the lathe saddle. The wire fasteners, or steel rings, vary in thickness and diameter, and are shrunk in position on the gun tube. Two recesses are got out on the face opposite the breach end; the first one is on a level with the tube, where the wire is secured previous to winding by a set-screw. The second is near the outside diameter and has a downward tendency to give a short depth to the fastening screw. The breach end of the tube is secured in a thimble chuck, and the muzzle end run on the poppet centre of the lathe, the latter being reversed for winding. The fastening ring being shrunk in position, the end of the wire is pulled from the drum, and passed through a pair of hardened steel dies. The tension on these is regulated by a hand wheel and screw arrangement. One inch of the wire is next bent edgewise at an angle of 45°, pushed into the first recess, and secured. After this, the lathe is set in motion, the saddle and wiring arrangement travelling in the same distance as the breadth of the wire at each revolution. The wire is wound on until it reaches one of the numerous shoulders on the tube; the lathe is then stopped, and a short piece of packing wire pushed between the shoulder and on a level with the preceding wire; this has the effect of neatly raising the wire for the return journey. The leading screw is reversed and the lathe set in motion again. The same action is repeated at each shoulder until the wire comes level with the second recess, when it is clipped tightly to prevent it unwinding, cut and bent as at the commencement, and finally secured by a set-screw in a pocket. Other rings are shrunk over the wire and filled in the same manner as the foregoing, until completed, when a light cut is taken over the whole surface with a spring tool.

Enamelling Slate.—Slate enamelling is done in various ways, each manufacturer having a particular method of applying the colouring matter and stoving. The following is a method which gives very good results. The slate used is known as hard blue Welsh slate, which is first cut into lengths by a steam-driven saw, and then rubbed or flatted down with pumice and water, until a perfectly level and smooth surface is obtained. It is then rinsed with cold water and placed in the stove to dry, after which it is allowed to cool, when it is given a coat of specially prepared enameller's black tar varnish, placed in the stove, and heated to 200° F. for from twelve to twenty hours. It is again taken out and rubbed down as before, until a perfect even dead surface is obtained, this process being repeated several times at some works according to the quality and thickness of enamel required. The slate should next be well dried and carefully examined for defects, as cracks, unevenness, etc., after which it should be given a coat of specially prepared enamel varnish and again stoved to 240° F. for several hours, when it is removed and polished by means of very soft woollen cloths and rottenstone. In some works it is finished by rubbing briskly with the palms of the hands, girls being generally employed for this purpose. The ornamental work, as lettering and scrolling, is done by experienced masons, using specially prepared chisels, gouges, etc. After the enamelling and polishing are completed gold leaf is applied, if necessary, in the ordinary way. Some manufacturers varnish over the gold leaf, but this is not recommended, as the varnish is found to go off dull after a few months' exposure to the atmosphere.

Cleaning Oil Drums.—To clean drums in which boiled oil has been stored, place in each ½ lb. of caustic soda, and fill up with cold water. Place them over a suitable fire and boil until the oil leaves the sides and bottom of the drums. Obtain a piece of iron or steel about 3 ft. long, 1 in. wide, and ¼ in. thick, sharpened at one end similar to a wood chisel; with this continually scrape the sides and bottom of the drum until all the loose oil and skin are removed. The drums should then be emptied and well rinsed with cold water to remove all traces of the soda, and then placed upside down to drain, after which they are ready for use. To reduce the cost somewhat, the soda solution may be repeatedly used until it becomes too thick or dirty with the oil. Steam may also be used instead of boiling over the fire; this method is adopted by oil manufacturers and others on an extensive scale.

Inlay Designs for Sideboard Doors.—The accompanying designs (see Figs. 1 and 4) are suitable for solid inlay, Fig. 1 being a sunk panel moulded door with vase design for inlay; this would look well in satinwood and mahogany, or holly and walnut. The edges of the inlay should be shaded by dipping in a tray of hot sand. Draw the design on stout white paper and paste it on the veneer; when dry, cut around the lines with a marqueterie-cutter's knife or a thin sharp penknife. Cut from outside to the centre, doing all the cross grain first; keep the knife wet. After the design is cut out, pin it to the panel and carefully draw in the outline with a sharp hard pencil, having first well chalked the panel. Cut around the outline with small chisels and gouges, and clear out the core with a sharp bradawl. Fill the sinking with glue, and rub in the inlay with a hammer face.

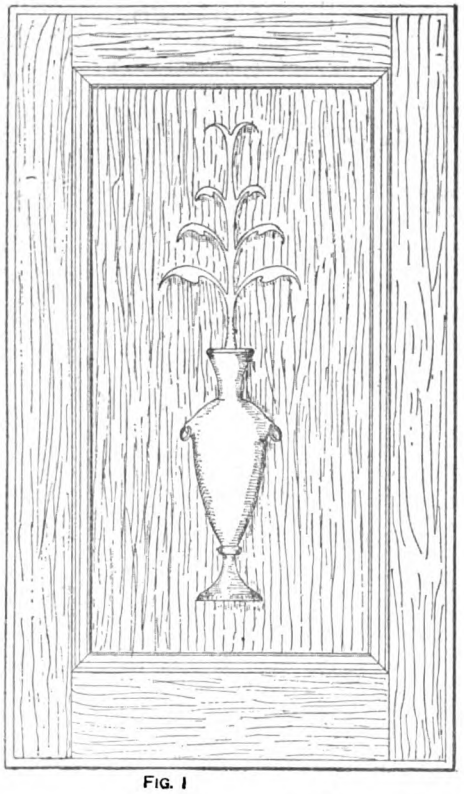


FIG. 1

FIG. 2

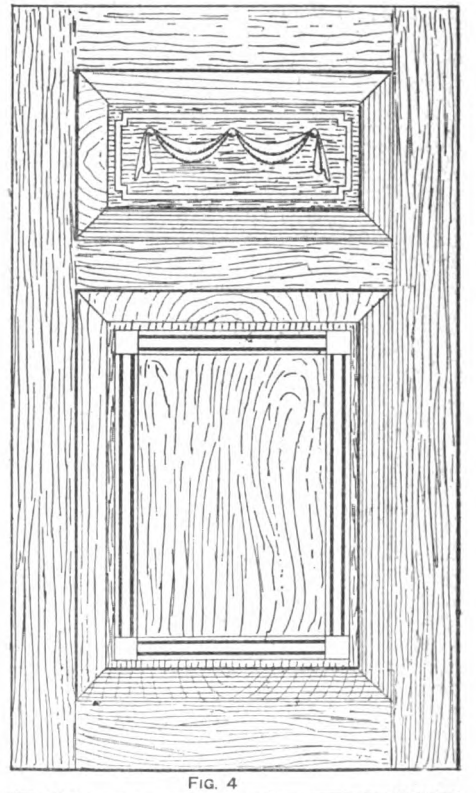


FIG. 4

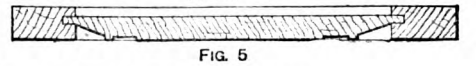


FIG. 5

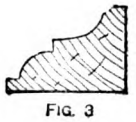


FIG. 3

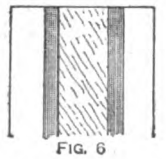


FIG. 6

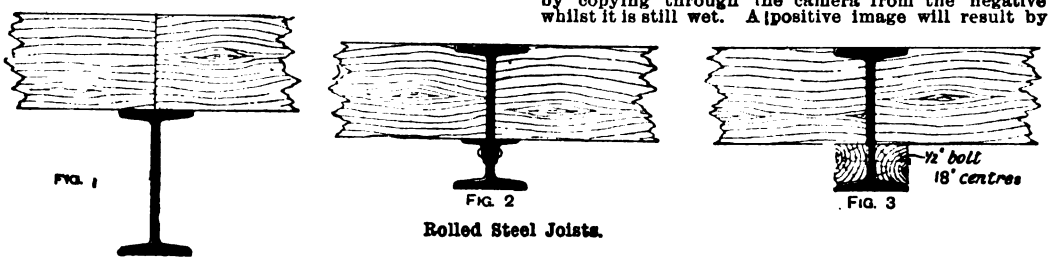
Inlay Designs for Sideboard Doors.

Fig. 2 is a vertical section of Fig. 1, and shows an edge band of inlay. Fig. 3 is a full-size section of the moulding. Fig. 4 shows the door with two panels, the upper one having festoons and strap inlay, the lower panel having striped banding. Fig. 6 is a full-size elevation of the banding; this may be purchased ready made in two or three woods and colours: the whites in satinwood, the blacks in blue, and the panel in dark mahogany would be effective. The panel is raised, with a sunk chamfer, which might also be veneered with satinwood. To prepare the panel for the inlay, set a cutting-gauge to the interior and also to the exterior lines of the inlay, and run the gauge all round the panel before chamfering. This will mark the grooves, which should be of such size that the banding will go in easily with slight pressure. The grooves and gauge lines must of course be stopped at the returns. The core may be removed either by chopping out with a chisel or, better, by running a quirk router through the sinkings, as shown in the section, Fig. 5. Cut the corner squares in first, then cut in the banding just so tight that it arches about $\frac{1}{32}$ in. Glue in the corners first, then glue a groove and the under side of the banding. Put one end in place and rub a hammer face along until the whole length is in place. Should it spring, hand-screw a piece of greased wood on the top, and do not remove the pressure until the glue is found to be hard and dry.

Jointing Manhole of Range Boiler.—The best way of jointing the manhole of a high-pressure range boiler probably is to employ an indiarubber collar. Suitable collars can be purchased ready made in all sizes. These collars are clean to use, quick, and need no preparation. There are no such failures as occur with an unevenly made red-lead joint, and any slight leakage can be made good by tightening the nut. There is, however, one fault with the rubber joint: the rubber softens when first heated and requires tightening up again, so that after the joint is made the water must be run in and the fire lighted before the workman leaves the job. If rubber is not used, recourse must be had to red- and white-lead and hemp. A putty is first made by mixing moist white-lead and dry red-lead to the consistency of ordinary glazier's putty. A little of this is thinned with boiled oil to make a thick paint, and kept separately. With this the surfaces of the boiler and lid, where the joint comes, are first painted. The putty, with strands of hemp bedded in it, is then put on the lid, and when the latter is in position and tightened up, a sound joint is the result. Some workers prefer to chop the hemp up and thoroughly mix it in with the putty. A piece of the mixture is then taken and rolled into a rope shape with the hands. It is coiled on the edge of the lid, and then put on the boiler and tightened up. Another way is to use a collar of soft cardboard, soaked in oil, in place of the coiled hemp.

Fixing Green Baize to Drawer.—Assuming that it is required to line the bottom of a drawer interior with green baize, proceed as follows. Prepare some strong thick paste by boiling a mixture of flour and water, with a little powdered resin added; or procure some bookbinders' paste, which contains dextrine and is very adhesive. Cut the baize slightly smaller than the drawer bottom, leaving a margin of about $\frac{1}{8}$ in. all round. Now lay the baize smooth side up (if a very rough baize is employed, its surface should be sponged with hot water and rolled flat with a ruler or any other cylindrical object that is handy) and spread the paste over the surface with a sponge; draw the sponge from one side of the baize to the other in straight and continuous strokes all in one direction until the whole surface is covered. Just enough paste should be left on to lay all the fibres, but not sufficient to soak through to the other side, or a stain will result. Next, with hot water, lightly sponge the drawer bottom and rub over it a little paste; lift the baize up by the two opposite edges, folding the dry surface inwards, lower the loop on to the middle of the bottom of the drawer, and spread the baize out flat in each direction with the hand. When the baize is arranged in position, with the roller roll out from the middle towards the edges, using a piece of rag to pick up the paste that is squeezed out. Then press in with the thumb a tintack at each corner to help in keeping the baize down whilst the paste is drying. The baize should not be touched until dry, which may take from one to three days, according to the weather. Thin glue applied very hot may also be used in like manner, and will dry quicker, but is much more difficult to manage.

Strength of Rolled Steel Joists.—The strength of rolled steel joists is not affected by the mode of fixing the common joists. Fig. 1 shows the simplest method of fixing them, but this method occupies valuable space by increasing the total depth; Fig. 2 is satisfactory, but expensive; Fig. 3 is the method commonly adopted, and is on all points the most economical.



Rolled Steel Joists.

Vignetting Bromide Enlargements.—For vignetting bromide enlargements cut a card according to the shape of the required vignette. If the negative is thinner on one side than on the other, and an even vignette is desired, the opening must not extend so far that way, as the light will always spread farther on the thinner side. In cases where the background is dark (and in such a case a thoroughly satisfactory vignette can never be produced, even with a lot of hand work), the vignette should be close round the figure and should be held near the bromide paper; if the background is light, the vignette may be placed farther away. By holding the vignette in the hand a slight movement may be imparted to it, which also tends to soften the edges. The movement, as a rule, must be in the plane of the vignette and not towards the lens, and should be only slight. When vignetting a lady with a black dress, in order to avoid showing the waist (which would look too large) a piece of card, edged with cotton-wool pulled out loose, is fastened over the portion to be obliterated, but must not come within sight of the vignette opening.

Garden Paths.—For a narrow gravel path it will be sufficient to excavate over the site of the path to a depth of about 9 in. below the intended finished level. Fill in 6 in. of this with broken bricks, good hard clinker, or broken stone, and ram this well so as to consolidate it as much as possible. On the top lay gravel and sand and roll with a garden roller. To make an asphalt path, excavate to a depth of 9 in. Put in the edging or kerbs of the path, and fill in the foundation as recommended above. The asphalt is laid in two layers. The bottom layer, about 2 in. thick, is composed of broken bricks or limestone broken to about 1 in. gauge and mixed with melted tar and pitch. The broken stone is placed in a heap on a wooden platform, the tar is poured over the heap, and the whole mass turned over several times with spades. Let the stuff remain thus for a week or two before laying. Lay this bottom course to a depth of 2 in., roll it well, and finish off with a coat of similar material but made of limestone only (no broken bricks) broken to a gauge of not larger than $\frac{1}{4}$ in. This finishing coat should be rolled and re-rolled until firm and smooth. A concrete path can be made by excavating to a depth of 4 in. Fill in 3½ in. of this with a rough quality of concrete, made by mixing one bag of Portland cement with two barrow-loads of sand and five barrow-loads of broken bricks or stone. With the flat side of a spade beat the concrete down and allow it to set. The finishing coat, about ½ in. or ¾ in. thick, should be composed of equal parts of Portland cement and clean, sharp sand, laid on carefully and smoothed with a plasterer's float. A very excellent path can be made of concrete flags, which can be bought ready-made, 2 in. and 2½ in. thick and 18 in. square. These should be laid on a bed of cinders and sand, and have the joints pointed with cement mortar.

Furniture Cream.—Recipes for white furniture cream are given below. (*a*) White wax 3 oz., pearlash 2 oz., water 6 oz.; boil together, then add boiled oil 4 oz., turpentine 5 oz. (*b*) Rainwater 1 gal., yellow soap 4 oz., white wax 16 oz.; boil together, then add pearlash 2 oz. (*c*) Turpentine 3 pt., castile soap 12 oz., white wax 12 oz., butter of antimony 4 oz., vinegar 1 gill.

Photographing direct upon Bromide Paper.—A picture may be photographed direct on to bromide paper, thus dispensing with a negative, by using rapid paper, giving about twenty times the exposure needed for an ordinary dry plate, and developing with metol and hydroquinone. Use the developer somewhat stronger than is required for a plate, and with one-fourth the amount of bromide required for ordinary bromide work. The result will, of course, be a negative. The writer knows of no practical method of producing a direct positive in this way. The paper prints that are so rapidly produced by some photographers are obtained by copying through the camera from the negative whilst it is still wet. A positive image will result by giving say one thousand times the exposure necessary for a plate. Another plan is to expose the bromide paper as if for the production of a negative, and then fog the paper by exposure to light for a minute or two before development. This has often been done as a lecture experiment, but is very uncertain.

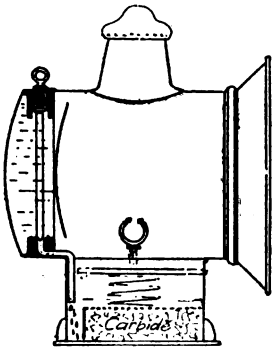
Dyeing Leather Black.—Below is explained how to dye brown leather a good black colour. Get some salts of tartar and some green copperas, and make a solution of each of these in soft water. Lay the leather out flat on a board and wash over carefully with the salts of tartar, using a sponge, and with the open hand rub the leather all over until nearly dry; afterwards allow it to become thoroughly dry. Now wash with the copperas solution, following the method above described; and when dry wash again with paste water—*i.e.*, water in which a little paste has been mixed; this will take away any whiteness that has been left from the copperas, and, if properly done, will produce a good black. But the tone will be governed somewhat by the original colour of the leather.

Drilling Pinion with Watch Turns.—To drill a pinion in a pair of watch turns, first mark the exact centre with a sharp-pointed chamfering tool. Then select a drill of the right size, harden it, and leave it quite hard; sharpen it well, and fix it in a hole drilled centrally up a brass runner to fit the turns. See that the drill is straight and true. To drill the pinion, fix a ferrule on it and set it up in the turns, the back pivot running in a centre, and the drill point (in the brass runner) running in the chamfered centre to be drilled. While the pinion is revolved by the bow, the brass runner with drill is held in the hand and a good pressure kept on it. Lubricate with turps, and keep the drill sharp.

Gunmetal.—The following alloys may be taken as typical samples of good gunmetals. Copper 57 parts, tin 24, zinc 29; copper 86, tin 11, zinc 3; copper 64, tin 16, zinc 22; copper 96, tin 13½, zinc 4½. A small quantity of lead is admissible in two or three cases only, as, for instance, gunmetal for glands and cocks, which may be, say, copper 80, tin 4, zinc 13½, lead 2½; and also piston rings, which may be, copper 82, tin 4, zinc 9, lead 5. For ordinary use, however, omit lead.

Wax Taper Manufacture.—Machinery employed in modern establishments for making wax vestas and wax tapers consists of a shallow jacketed pan for melting the wax by steam, and a large revolving drum on each side. On one side of the pan, between it and the drum, is a plate of steel with a number of holes about ¼ in. in diameter drilled through it. The wicks are wound on one drum, and are drawn through the bath of melted wax; then each set of wicks is drawn through one of the holes in the steel plate and on to the other drum. The wax is heated to a few degrees above its melting point so that it sets on the wicks quickly; the steel plate removes the excess of wax and forms the tapers round. The taper material is quickly unrolled from the second drum, laid on a table, and cut to proper lengths with very sharp knives.

Acetylene Lamps for Vehicles.—Acetylene plants that work quite perfectly for residences are numerous, but whether any self-contained lamp for cycles, automobiles, and other vehicles is perfect is doubtful, owing to the fact that it cannot be attached to an adjustable gasholder that will receive the gas of over-generation and after-generation. The exact quantity of acetylene that is made is not the exact quantity of gas that is used; acetylene must be made in excess, or the light will fail. To allow for this, vehicle lamps are provided with means (a kind of miniature safety valve being often used) by which this excess of gas escapes or is wasted; the gas of after-generation (that which is produced after the water supply is stopped and the flame extinguished) is also allowed to go to waste. Some



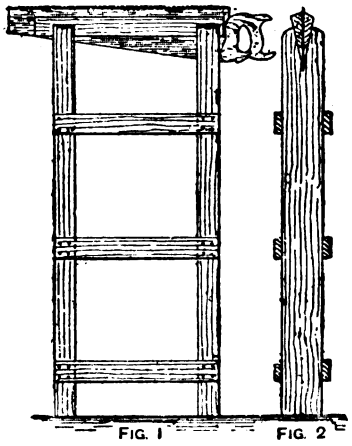
Acetylene Lamp for Vehicles.

lamps are unprovided with means of extinguishing the light, and the gas of after-generation is then allowed to burn out in the house or stable. The accompanying illustration shows a favourite method of regulating the water supply to the carbide, and, consequently, regulating the production of gas, and it is thought that this device does not infringe any patent. The water vessel is at the back of the lamp. The flow of water to the carbide chamber is a very slow drip, and this drip is regulated by the conical-ended screw pin shown in the illustration. The carbide holder is shown under the centre of the lamp, but a better plan would be to have the holder under the water chamber, so that the small tube from one to the other can be quite straight, which would be desirable for cleaning purposes. The water should not be allowed to drip on to the top of the carbide, but should rise from below, as shown. In all vehicle lamps a piece of coarse-mesh wire gauze should be placed over the carbide and held down by a broad form of spring. This device is necessary in order to prevent disturbance of the carbide and irregular results caused by jolting of the vehicle. The lower part of the lamp carrying the carbide chamber must be readily detachable for purposes of recharging and cleaning, but of course it should be gastight.

Recharging Seltzogene.—To open a seltzogene unscrew the metal cap containing the valve and tube. For charging, first thoroughly wash out the vessel and allow it to drain, then the lower bulb must be nearly filled with water, poured through a funnel which penetrates the neck of the bulb; no water should be allowed to get into the upper bulb. When the lower bulb is nearly filled, the funnel should be withdrawn and the small conical plug put in the neck of the lower bulb to prevent any powder getting in. A charge of powder is now run into the upper bulb by means of the funnel, and after the funnel and the conical plug are removed, the cap must be screwed in again. On placing the seltzogene on its side some of the water flows out of the lower bulb into the upper one, and meeting with the powder causes it to effervesce, the gas evolved being absorbed by the water in the lower bulb. A minute later about a wineglassful of water should be drawn off and the seltzogene shaken gently once or twice. After about half an hour the aerated water may be drawn off for use. Powders for charging the seltzogenes may be obtained from any chemist. The necessary ingredients for the charge are stated in Series I., p. 159; they are in the proportion of 1 oz. of tartaric acid and $1\frac{1}{5}$ oz. of bicarbonate of soda for a 3-pint seltzogene.

Gold Bangles and Bracelets.—In making hollow gold bangles and bracelets, draw the gold plate over well-annealed charcoal iron wire, turn the plate up round a mandril of the size required, and cut off. The inside metal (the iron) may readily be dissolved out by using dilute sulphuric acid. The best alloy of gold to withstand the action of the acid is made by melting together 15 parts of fine gold, 3 parts of silver, and 6 parts of copper.

Re-covering Clappers of Smith's Bellows.—For re-covering the clappers of a smith's bellows, it is necessary to remove the old leather from the clapper, and get a new piece of stout sheepskin leather, known in the trade as basil; place a thin packing of wadding between the clapper-board and the leather, and then nail the leather round the edges of the clapper.



Hand Saw Vice.

Hand Saw Vice.—The vice for hand saws, shown in front and side elevations by Figs. 1 and 2, may be made of two pieces of 4-in. by 2-in. deal, 4 ft. long, held together with six pieces, ¾ in. by 2 in., nailed on. The uprights are rounded at the top, and have V-shaped notches, 4 in. deep, cut in them, to take the wedge-sectioned cheek pieces (see Fig. 2), which are best if made of walnut. The vice simply stands against the bench, the saw is placed in notches, and the cheeks are pressed down tightly with the fingers.

Re-waxing Meerschaum Pipe.—A meerschaum pipe may be re-waxed after first carefully cleaning the pipe with soft rag wetted with methylated spirit and dipped in pumice powder, finishing with clean, soft rag. To re-wax, place a small spirit lamp beneath the pipe, but near enough to the pipe to keep it sufficiently warm to melt a piece of white wax held against it. Let the wax touch those parts only which are intended to be coloured, and when the pipe is cold, wipe off the superfluous wax with a soft rag. Pipes can also be re-waxed by merely making them hot enough with smoking to melt the wax. Any colouring wrongly placed can be removed by dipping the bowl to the required depth in chloroform. Re-waxing demands care and patience.

Bloom on Green Paint.—Bloom that has formed on green paint may be due to one of several causes. Perhaps the most probable cause is that the green pigment has not been washed sufficiently clean or free from acid during the process of manufacture. When preparing green pigments for any particular purpose, avoid as far as possible mixing with basic colours as zinc white, white-lead, orange chrome, and ultramarine, as the mixture sooner or later is destroyed, owing to these pigments containing traces of sulphur and alkaline bodies. Any traces of lime would also cause the bloom complained of.

Preventing Water Freezing.—Chloride of lime (bleaching powder) is employed for preventing water from freezing, but it cannot be put in drinking water or water used for many other purposes. It is commonly used for the water in hot-water heating circulations, which are allowed to get cold in frosty weather (in churches for instance); but in this case it is best to buy the solution ready prepared.

Portable Greenhouse.—Fig. 1 shows an end elevation, and Fig. 2 part of side elevation of a portable greenhouse, the sections of the ground showing sockets with posts fitting in them. By having a number of these sockets fixed in different parts of the ground, the greenhouse can be removed from one site to another, as may be required by the plants, and to retain these sockets in their positions, it will be necessary to put a layer of Portland cement or concrete all round them, and the greenhouse

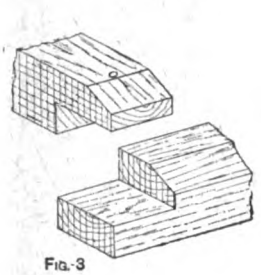


Fig. 3

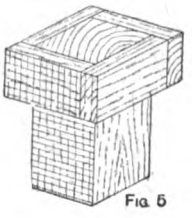


Fig. 5

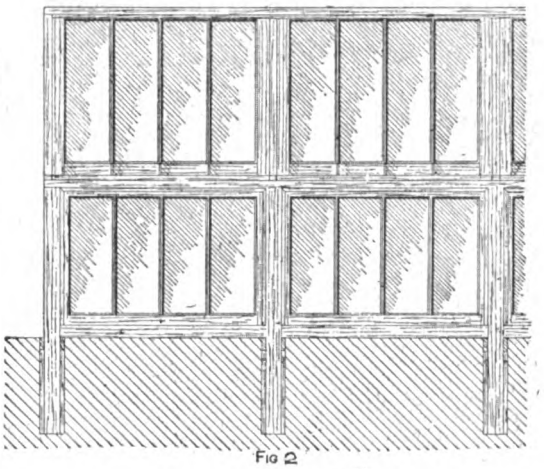


Fig. 2

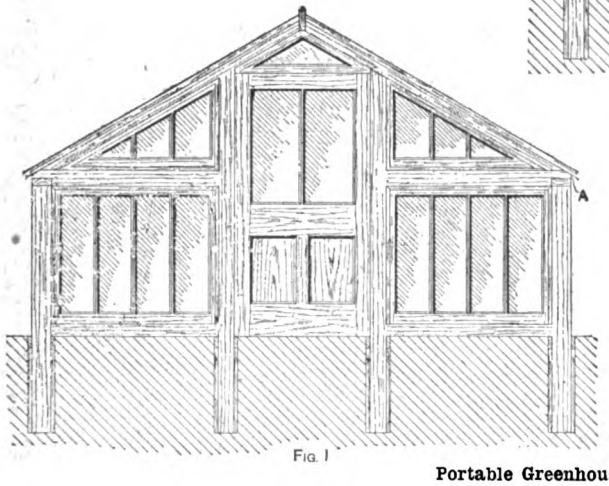


Fig. 1

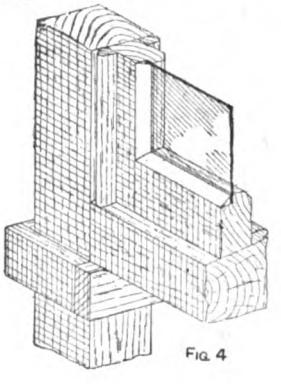


Fig. 4

Portable Greenhouse.

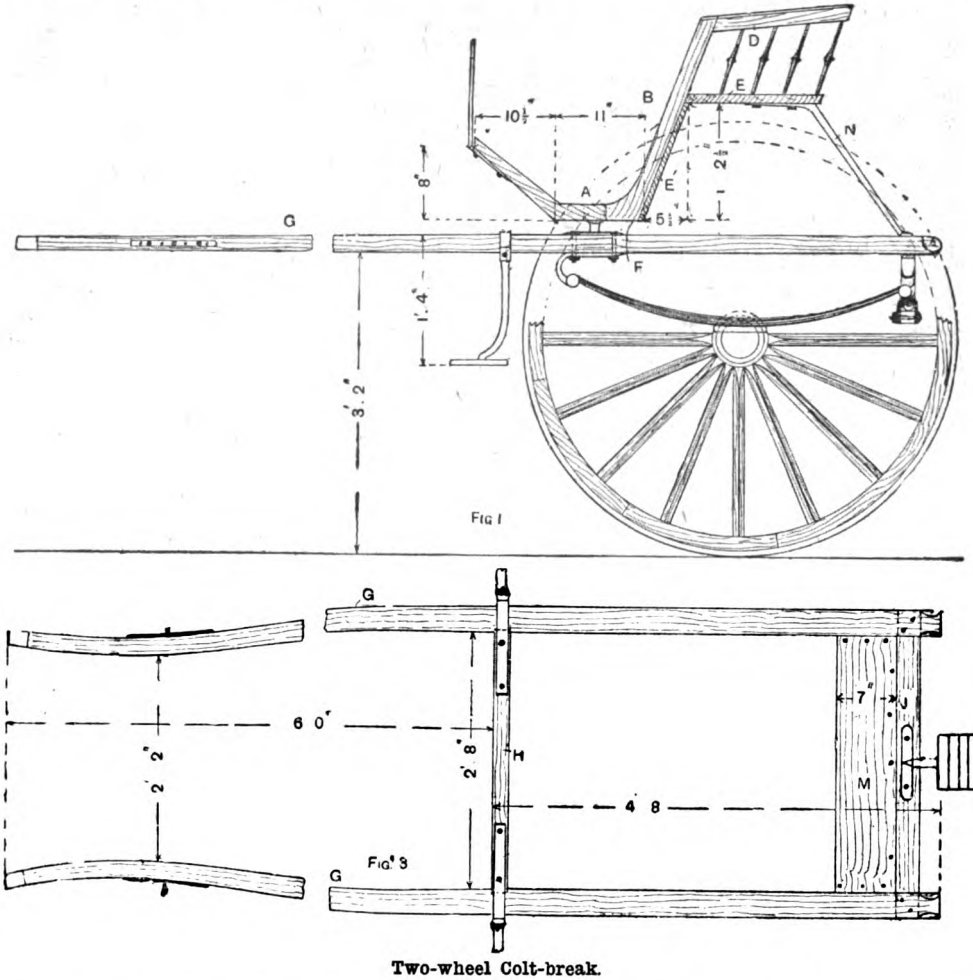
must not be removed until this is set. Fig. 3 illustrates the joints of the framework at A (Fig. 1), the other joints being ordinary mortise-and-tenon joints. For holding the framework together and for expeditiously taking it apart, the principal joints should be made by screws. Fig. 4 shows the method of holding the lights in position between the posts. This is done by nailing a guard bead inside and out so as to form a groove in which the lights slide. When the greenhouse is moved to a new site each socket should have a plug (Fig. 5) dropped into it to keep out dirt, etc. For hinging such of the roof lights or side lights as require them, lifting hinges will be found most suitable. As the posts go in the ground the sills drop between them. The lights and door will, of course, be of the ordinary construction.

Hardening Cast Steel Hammer.—To harden the faces of a cast steel hammer that is several pounds in weight, make the hammer red hot all over, then grasp it with a pair of tongs through the eye; slack one face of the hammer for about 1½ in. up until quite cold in water, then slack the other face for the same distance up, thus leaving the centre of the hammer hot to bring the faces to the right temperature for hardening. When the faces are cooled out, rub them bright with sandstone, and when they are of a deep straw colour cool them alternately in the water to arrest the softening process, and so continue until there is not sufficient heat in the centre of the hammer to make any difference to the faces. By this means the faces will be hardened and the eye of the hammer left soft. If there is not sufficient heat in the centre of the hammer to bring the faces to the desired colour, a piece of hot iron should be placed through the eye.

Marbling Mantel and Staircase.—For finishing a mantel and stairs in imitation of green marble, first prepare by rubbing the surface of the mantel perfectly smooth with No. 1 glasspaper, and apply a coat of black or dark coloured distemper mixed with a little raw oil to fill all inequalities; again rub down and dust, and apply a coat of black paint mixed with boiled oil and a little driers and turpentine. Then give a second coat of paint mixed with 3 parts of oil and 1 part of turps; rub lightly with No. 0 glasspaper and dust well. The marbling may now be proceeded with. Obtain some white-lead, and light and middle green paint ground to a paste in oil; moisten a long stiff feather with turps, and place a small quantity of each of the colours on the feather and draw it over the work in the style to be imitated. Allow to dry, then apply a coat of hard copal varnish. The stairs and skirting boards should be well rubbed with No. 1 glasspaper, and a coat of black paint mixed with 2 parts of oil, 1 part of turps, and a little terebine applied; in some cases two coats are necessary. The marbling should then be done as above, finishing with a coat of hard copal or inside oak varnish.

Oiled Silk.—Oiled silk for dressing wounds is prepared by laying the plain silk on a table and applying a coat of oil gold size or boiled linseed oil to one side. The silk should then be hung up in a warm place to dry quickly.

Painting Bands round Pillar.—One method of painting the perfect bands on pillars is to place a straightedge against the pillar and make a mark or dot with a lead pencil at the desired height. Now move the straightedge about 1 in. and make another dot, and continue this all round the pillar. Now place round the pillar, just touching the pencil marks, a piece of strong paper. A sash tool dipped in the chosen colour should be used to stencil on and below one edge of the paper. When the paper is removed, a perfectly clean and sharp line will be found. Treat the other edge in a similar manner, then fill between the lines in the ordinary way. Another method is to procure a piece of stout paper the exact circumference of the pillar, and about 9 in. deep, the ends being cut exactly at right angles to the length or parallel to each other. Place the paper round the pillar, the bottom edge of the paper just touching the part where the top of the band is required. The extreme ends of the paper should now just touch each other, and its top and bottom edges should be perfectly even; the circle or band will then be at right angles with the pillar and may be stencilled on as before. This method is useful when the height will not admit of a straightedge being used. The worker requires an assistant to hold the paper while stencilling.



Two-wheel Colt-break.

Two-wheel Colt-break.—In the accompanying illustrations Fig. 1 is a side elevation of a two-wheel colt-break built on the lines of a gig, but without the body part; Fig. 2 (p. 43) is a back view; Fig. 3 is a top plan of the framed shafts. In making the break, the brackets A (Fig. 1) and sham door B (Figs. 1 and 2) are got out to pattern in thoroughly dry English ash; the brackets are 2 in. deep at the bottom, tapering off to the top, 2¾ in. wide, and are half checked on to the sham door B (Fig. 1) from the joint to the back end. The sham door is cut out of 2¼-in. plank to the shape of Fig. 1, and the turn-under sweep is as shown in Fig. 2; the seat E (Figs. 1 and 2) is 1 ft. 6 in. wide by 2 ft. 11 in. long, of 1-in. birch; the top rail D (Figs. 1 and 2) is compassed, and is of English ash 2¼ in. square; it must be obtained from a timber bender. When dressed up, the rail is 2 in. deep, worked round to the bevels to 1½ in. in thickness; the turned sticks are ⅞ in. in diameter at the end, tapering to the swell in the centre. The heelboard E′ (Figs. 1 and 2) is ⅞ in. thick, and may be of birch or whitewood; the bottom boards are boxed or rebated into the inner bottom edge of the brackets A (Fig. 1), and the cross bar is framed in at F. The width of the break across the bottom is 2 ft. 4½ in., and across the top rail D (Figs. 1 and 2) 3 ft. 6 in. outside; the clear distance on the seat between the sham doors is 2 ft. 7 in. The shafts G (Figs. 1 and 3) are of ash, 6 ft. long in front of the bar H (Fig. 3), and 4 ft. 8 in. from the front of the bar to the extreme end. The shafts are 2¾ in. at the back end by 2½ in. deep, tapering to the front as shown in Figs. 1 and 3. The hind bar J (Figs. 2 and 3) is 2¾ in. wide, framed through the shafts as shown; it takes the hind flaps of the span-iron K (Fig. 2), which takes the cross-spring, this being fixed to the flap of the span-iron by two spring clips and couplings, with a ¾-in. ash block fitted to the compass of the cross-spring between. The hind step L (Fig. 2) is for a man to get up and stand behind the driver on the board M (Fig. 3), in case the driver cannot manage to get the colt along; there is generally a long leather strap with a loop at the bottom end fixed round the centre of the top rail of the seat. To secure the board M (Fig. 3), fillets of ash 1¼ in. deep by 1¼ in. wide are fixed on the inside of the shafts and bar, the fillets

being kept level with the bottom of the shafts and bar; a piece of 1-in. birch is fitted between the shafts and fixed by screws. The two stays N (Figs. 1 and 2), to support the seat, are of 1-in. oval iron, tapering towards the bottom, with a long flap to go under the seat (see Fig. 1), and with tee flaps at the bottom on top of the shafts and bar. The wheels are 4 ft. 6 in., Warner's; the stocks are 7 in. in diameter at the band of iron, mortised to take sixteen 1¼-in. spokes, the length of the stocks being 8½ in. The axle O (Fig. 2) is a Collinge, 1¼ in. in diameter, with solid flaps for 2-in. springs; the distance between the flap and collar of the axle is 1¼ in., and the boxes of the axle are 9 in. long. The side grasshopper spring is 3 ft. 6 in. long to the centre of the eyes, the compass from the centre of the eyes to over the last plate being

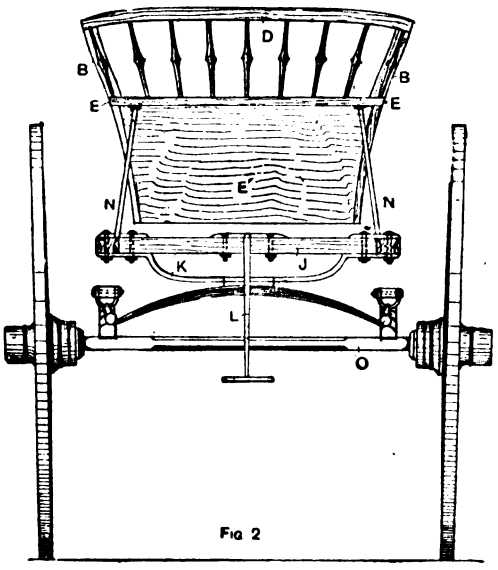


FIG 2

Two-wheel Colt-break.

5 in., and the number of plates six, of 2-in. steel. The cross-spring is 2 ft. 11 in. to the centre of the eyes; the compass from the centre of the eyes to over the last plate is 4½ in., and the number of plates six, of 2-in. steel; the springs are fixed in front in an open jaw scroll iron, kept in position by a ⅝-in. bolt. At the back end the springs are attached to the cross-spring by four D shackles, with four ⅝-in. bolts through them; the track of the wheels is 4 ft. 4 in. The back is kept rather wide for such a narrow bottom at the brackets, to prevent the break being turned over.

Laying Oak Floor on Old Boards.—In laying an oak floor of narrow boards on top of an old floor, the proper and most workmanlike manner will be, first, to level off all projecting knots and other inequalities with a plane, and any parts where the floor is very much worn must be firred up, and made quite level to a straightedge; the firring must, of course, be done the opposite way to the joints of the new floor so that the latter will have an equal bearing over the whole area. If the new floor is laid without firring up the old one, the job will prove very unsatisfactory and give constant annoyance owing to its uneven surface and creaking joints.

Rubber Stamps.—The would-be rubber stamp maker is often discouraged on finding that uncured rubber must be obtained, and that it requires careful treatment by heat; however, below is described a method of making indiarubber stamps from rubber already "cured," the material that many are familiar with in its applications to tyre making, particularly for inner tubes. Unfortunately the process has its limits, but for many purposes it is, when skilfully put into execution, equal in results to mould-cured productions. A piece of grey sheet rubber, readily provided from the remains of a worn-out inner tube, or to be bought direct from any cycle or indiarubber dealer, will be required. When bought in the sheet it is known as "patching rubber," and most repairing outfits contain small pieces of suitable rubber. Fix it down to a piece of smooth flat board, which for small jobs may be about 6 in. or 9 in. square. Ordinary thin glue will do this, but many other cements will also accomplish it. When firmly fixed and quite flat and smooth, draw the required design or lettering on the top surface. If preferred, printed letters, etc., can be cut out and pasted on the rubber instead of being drawn. When dry (in the latter case) use a sharp knife to make a vertical cut to penetrate the rubber all round the outlines of the pattern or letters down to the wood on which the rubber is stuck. Every time it is removed from the cut, moisten the edge of the knife by applying the tongue to it. It is not advisable to saw the blade backwards and forwards when cutting; merely press down. An alternative way is not to stick the rubber to the wood, but to cut it with a pair of sharp scissors, though these are more likely to produce jags and uneven cuts than the knife. When cut out the rubber may be stuck to a wooden handle with a flat end big enough to take it, and can then be used with an ink-pad in the ordinary way. It will be seen from the above that small-lettered type would be beyond the scope of the process; but for monograms, for large letters such as are usually stencilled, and for designs of all kinds, it will give complete satisfaction to the careful workman. Type, etc., must be cut in reverse, and if printed letters were stuck down, the rubber must be mounted so that its hitherto underneath surface becomes the working surface.

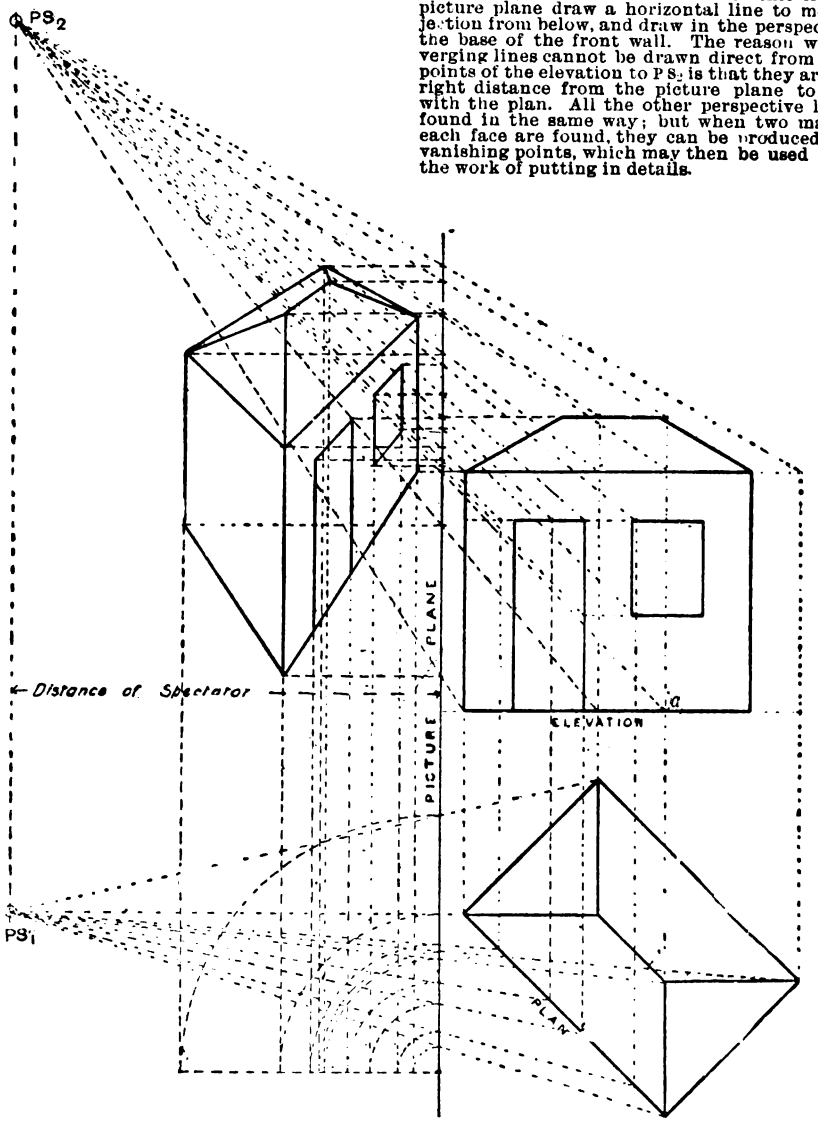
Painting Mailcart.—The method of painting mail carts usually adopted by manufacturers, which is far better than enamelling, is as follows. Obtain 1 lb. of olive green colour, ground to a paste in turpentine, add two tablespoonfuls of gold size, mix well together, and thin down to proper consistency with turpentine. The mailcart should be given one coat and allowed to dry thoroughly, when it should be lined out with light stone, middle chrome, or pale blue, which should be prepared from good quality paste paints thinned down with turpentine, adding a little gold size as a binder. Finish off with a coat of hard-drying copal varnish.

Cement for Fixing Fireclay Bath to Marble Base.—For fixing a fireclay bath having an uneven bottom outside on a marble floor a cement is necessary to bed the bath on. As the cement will not be seen, a mixture of red- and white-lead with linseed oil varnish or old boiled linseed oil, mixed together to the consistency of very soft putty, should answer well. If something cheaper is required, then take 5 parts of white-lead, 2 of red-lead, and 4 parts of pipeclay, and mix with linseed oil varnish. An even cheaper mixture is made up of 24 parts of Roman cement, 8 parts of white-lead, 2 parts of litharge, 1 part of powdered resin, and 8 to 10 parts of boiled linseed oil.

Neat's-foot Oil.—Neat's-foot oil is made from the feet of oxen, etc., obtained from slaughterhouses. The feet are first washed in cold water to free them from any dirt or blood; the sinews are then removed, and the hoofs placed in boiling water to soften. They are then disjointed with a knife to sever them from the large bone. The latter is boiled for some time by steam, and the remainder is boiled in a pan with water which has been used previously for the large bones. The water is next left for some time so that the oil may rise to the surface and be skimmed off. The oil thus collected deposits a thick stratum of dirty semi-fluid fat, from which the supernatant portion is decanted. These are known as first and second qualities. Neat's-foot oil has a pure straw colour, sometimes with a slight greenish shade, and when fresh has a peculiar mild taste and odour. Its specific gravity is 0·915, and it solidifies at 28° F. It keeps a considerable time without turning rancid, but is subject to many adulterations which may often be detected by taste or odour, the principal adulterants being horse-foot oil, sheep's trotter oil, and very often fish oil. It forms when pure an excellent lubricant for light machinery, as clocks, phonographs, cycles, etc. For use with watches, 2 parts of benzine to 1 of oil should be mixed together and placed in a room at 40° F. and allowed to stand two or three days; then pour off the clear fluid, evaporate the benzine with water bath, and repeatedly agitate the oil which remains with 5 per cent. of fine carbonate of soda; place the oil in bottles, close these well, and let the oil stand to settle several weeks, when the clear oil may be decanted off. The oil thus produced may be used on the finest and smallest mechanical work. It remains fluid below freezing point, being therefore rich in olein.

Dissolving Russian Isinglass.—Isinglass may easily be dissolved by boiling with water under pressure in a digester, which is an iron or copper pan, with a lid which can be fixed on and made tight with rubber packing; in the lid is a valve fitted with a lever and weight to regulate the pressure at which steam will blow off. In dissolving isinglass by ordinary boiling, if alkali is no detriment to the material, a very little caustic soda added to the water will help to bring the isinglass into solution.

Bird's-eye Perspective.—The principle of making bird's-eye perspective views is shown in the accompanying illustration, which, however, looks distorted owing to the position of the spectator being taken very close in order that all the lines may be kept within a small compass. Draw a vertical line to represent the section of the picture plane. Place the plan near it so that the sides make 45° with the plane. Select the point of sight or position of spectator (PS_1 in plan) opposite the nearest angle, not less than 12 in. from it, or at such greater distance as will include all lines within an angle of 30°, and draw lines from all points of the plan to the point of sight; the lines may, however, if preferred, be drawn singly as they are wanted. Now draw a horizontal line at or below the lowest intersection with the picture plane, and turn all points through a quadrant on to this line. These points projected upwards will give lines in which the perspective points will lie. Now draw the elevation of the building the same distance from the picture plane. Select the point of sight in the elevation about 45° above the nearest corner of the roof, and the same distance as before square out from the picture plane; or in other words, project from the plan of PS_1 to cut the line of 45° in elevation in point PS_2. For perspective view commence with the bottom left-hand corner of the elevation, draw a line to PS_2, and where the line intersects the picture plane draw a horizontal line to cut the projection of the similar point from the plan. Now take the bottom right-hand corner of the plan and project upwards to the base line of the elevation, and from this point (marked *a*) draw a line to PS_2. At the intersection of this line with the picture plane draw a horizontal line to meet the projection from below, and draw in the perspective view of the base of the front wall. The reason why the converging lines cannot be drawn direct from the various points of the elevation to PS_2 is that they are not at the right distance from the picture plane to correspond with the plan. All the other perspective lines will be found in the same way; but when two main lines on each face are found, they can be produced to find the vanishing points, which may then be used to facilitate the work of putting in details.



Bird's-eye Perspective.

Painting Grandfather Clock Dial.—Floral and other designs are painted on grandfather clock dials in oils by hand. To repaint first remove the old paint and thoroughly clean the plate; it is then given a coat of white enamel. The minute circle is struck, and the hour marks can be transferred by a tracing made on paper from the old marks before removing them, or they can be re-marked with the aid of compasses. First set the 12 and 6 o'clock on a perpendicular line, then the 3 and 9 on a horizontal line at right angles to the first line. Then with the compasses divide one of the quadrants into three equal spaces and step them round the circle, thus marking the other hours. To mark the minutes, divide one hour division into five by the compasses by trial, and, when correct, step the compasses round the other hours.

Essences of Cinnamon, Lemon, and Orange.—These essences are easily made by dissolving the essential oils in spirit of wine. To make cinnamon essence, dissolve 1 oz. of oil of cinnamon in 20 oz. of rectified spirit. For essence of lemon, dissolve 1 oz. of oil of lemon in 8 oz. of spirit of wine, add 1 oz. of grated fresh lemon peel, allow to stand for two or three days, then filter. For orange essence, proceed as in making lemon essence, but using oil of orange and fresh orange peel.

Hardening Tallow.—Tallow candles "gutter" because the tallow melts at a low temperature, and in a candle made of tallow alone much more melts than can be drawn up by the wick and burnt; also currents of air cause the heat to play on one side of the candle, thus melting it and allowing the material to fall down that side. To obviate the first difficulty, it is necessary to add to the tallow a material of higher melting point than tallow; cerasin wax with a melting point of 150° to 160° F. is often used for this purpose. Carnauba wax is also useful, its melting point being 180° F., but it is difficult to incorporate it with tallow, as it tends to separate out in a granular state at the low temperature at which tallow candles are made. To prevent "guttering" from air currents, the candles should be fixed in sconces and covered with lamp glasses.

Sawing Stool.—The illustrations show the kind of stool in common use by carpenters. Fig. 1 is a general view, Fig. 2 a side elevation, Fig. 3 an end elevation, and Fig. 4 the joint between the leg and the top. The suggestive sizes are figured on the drawings. The scantling can, of course, be increased or decreased, according to requirements.

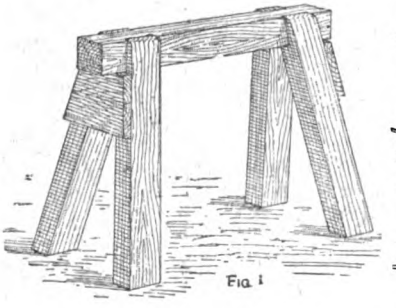
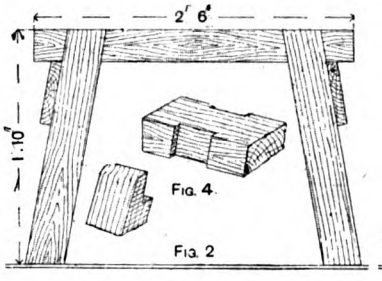
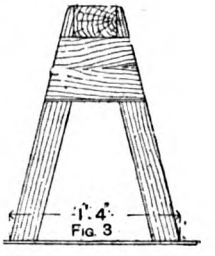


Fig. 1





Sawing Stool.

Diamond Setting.—To make a star setting for a single stone in a ring, a hole is drilled and opened out to a little smaller than the stone; a ledge is then cut round for the stone to lie in, leaving a depth of gold above its edge sufficient for the corns or claws to press over it. The star points are then cut with a graver, leaving a corn in the centre of the broad base of each. This corn is undercut at the back so as to facilitate bending. The stone is then placed in, and the corns bent forward so as just to hold it. A small punch and light blows all round equally will bend the corns over the edge of the stone firmly. The ring can be conveniently held on a tapered stick.

Covering Tilt of Box Van.—It is not usual to cover tilts with a number of small pieces of material; one or two pieces are generally employed. When two pieces are used, they are joined on top in the centre of the roof, brought down each side, and fixed to the bottom rave of the tilt. To make a good job, procure some black dressed canvas 60 in. wide, or double brown canvas 72 in. wide. To save painting, japanned canvas, 72 in. wide, can be obtained, this having a black surface and being very smooth; when put on a tilt where writing has to be done, it must have the gloss taken off by fine pumice powder and a pad of cloth and water, and a coat of varnish must be given after the writing is done. For a white cover procure some white double-texture waterproof sheeting which does not require painting, and black writing would show up well on the surface. Neither the japanned canvas nor the white sheeting requires sticking down, as each is stretched tight with a pair of pincers with tee-shaped jaws, and taken to the bottom of the tilt, where they are fixed. If brown canvas is used, which costs about 2s. 6d. per yard, the tilt would have to be given a very heavy coat of smudge paint, which is the draining of all paint pots and varnish cans. When taken from the tub, the paint should be thinned down, so that it may be strained through a hair sieve or some coarse glueing canvas. To tell when the paint applied to the tilt is tacky, place the finger lightly on the paint, then remove the finger slowly; if the paint adheres to the finger and comes up in the form of small threads, the canvas can be put on, stretching it out as tight as possible. Then make a pack of canvas and well rub the surface from the centre to over the corner, an assistant pulling it tight at the same time. A sleeker of wood or iron with a round end is then used to press out the superfluous paint, and will make the canvas stick to the tilt.

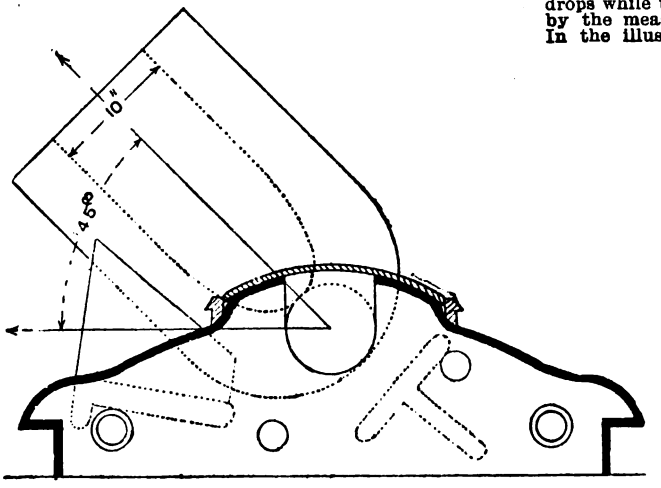
Piano Soundboards.—Piano soundboards usually are made from Swiss pine, but may also be made from American pine or spruce; the wood must be perfectly clean, free from shakes and knots, and thoroughly dry; ¼-in. boards are used, and these, when planed on both sides, should finish out ¾ in., being a trifle thicker at the treble end and at the bass bottom edge. The bars that are glued on the back between the bracings are planed up slightly camber, the middle standing up ¼ in. higher than the extreme ends, and these when fixed into position will give the soundboard a slightly arched appearance. The method of fixing is by "go bars," lengths of lancewood slightly longer than the distance between the ready planed-up board when resting on some firm foundation, such as the floor, or on stout boards placed across trestles, and the ceiling above. The latter in piano shops is of wood, not plaster. The bars being glued on, the "go bars" are sprung into position, at least three on each bar, consequently giving a strong downward pressure. They may also be fixed by glueing one bar on the back in its position and using another at the front, which, however, must not be glued, the rounded or camber edges being of course next the soundboard. Hand-screws are put on the extreme ends, exerting pressure till close contact is assured.

Black Japan or Shiny Black.—For making a quantity of black japan, or shiny black, melt 8 lb. of finest asphaltum in a suitable vessel and afterwards add 1½ gal. of pale boiled oil. In another vessel run 3 lb. of copal gum with a gentle heat over the fire, and add 5 pt. of best drying oil; stir well and raise the temperature to 500° F., then add steadily 1 lb. of red-lead, 1 lb. of litharge, and 2 lb. of white copperas. Boil well until the mass turns stringy and sets between the fingers when cool, then mix the contents of the two vessels together, allow to cool somewhat, and stir in carefully 5 gal. of American turpentine. Allow the mixture to repose for about fourteen days, when it is ready for use. It dries hard with a lustrous coat in about eight hours.

Cleaning Rainproof Overcoat.—A fawn-coloured rainproof overcoat that has become dirty may be cleaned in the following way. Cut ¼ lb. of Castile soap (white) into shavings and boil with 1 qt. of water till dissolved; then remove from the fire, and when somewhat cooled add 5 oz. of methylated spirit. Spread the overcoat over a table and brush it well with the hot soap solution. This should be applied to one portion of the coat at a time and immediately afterwards wiped out again with clean wet cloths. After going over the whole of the coat in this way, wring out the cloths and again rub over the coat. Any very dirty portions may have a little fuller's earth rubbed on while wet. Now dry very slowly, and when nearly dry place a cloth over the collar and cuffs and iron them with a moderately hot iron; after this finish drying. If the overcoat is rubber-proofed do not use the iron. The materials mentioned may be obtained from any chemist.

Welding Steel to Iron.—Below is described a method of welding a piece of steel 5 in. long by 4 in. wide to a piece of iron 6 in. long, 5 in. wide, by 2 in. thick. First of all, ascertain the welding qualities of the bar of steel by submitting a piece of it to a practical test and seeing at what heat the steel will weld. When these particulars have been ascertained, cut off the piece of steel that is to be welded to the iron, and cut this piece a little longer than the finished size, so that to it a light porter bar may be welded; by the help of this porter bar the steel can be more easily manipulated in the fire when getting the welding heat. If the operator has only one fire to work with, a good blast is indispensable; there should also be a fairish sized hole in the tue iron so that the blast may spread and make a fairly large area for obtaining the welding heat. The iron should be brought to a fair white heat and the steel to a kind of slimy heat, using for a flux some clean sharp sand if the steel is of good welding quality; if not, use sand and burnt borax mixed.

Mortar for Firing Bombs.—A mortar, as may be seen from the accompanying illustration, is a very short piece of ordnance (having the trunnions at the end) intended to throw shells at high angles of elevation, usually 45°, variations in range being obtained by alterations in the charge of powder. The mortar rests on a mortar bed, the elevation being, as a rule,



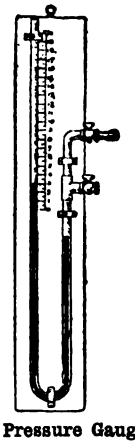
Mortar for Firing Bombs.

constant. Mortars are not at present used in the service, but many large ones are still mounted in fortresses. Mortars were found useful for dropping shells into a confined space such as a fort or bastion, but they are not able to hit a particular object, such as a gun. Mortar shells which drop from a great height are capable of breaking through insufficiently protected powder-magazines, and searching out the weak buildings of a place generally. Their fuses were regulated so as to burst immediately after, but not before, striking the object. A small mortar may be made of brass.

Salicylic Acid Distemper Medium.—The following is a salicylic acid medium for distempers. Take glue size powder 5 lb., crude glycerine 12 oz., glucose 8 lb., salicylic acid 2 lb. Dissolve the glue size in about 5 gal. of boiling water; in another vessel dissolve the salicylic acid with warm water, then mix both together after cooling somewhat, finally stirring in the glucose and glycerine. Should the mixture jellify, add more boiling water. This preparation should be used as a medium for mixing dry colours for distempers. Salicylic acid is poisonous.

Method of Running 4-in. Hot-water Pipes.—For heating a room by means of four 4-in. pipes run all round in a grated channel about 600 ft. of pipe will be required, and to make all the piping uniformly hot the best plan will be to divide the piping into two circulations. Let a 4-in. flow start from the boiler, then with an outlet syphon continue the piping as two 4-in. pipes all round the building, ending at the boiler. This will be one circulation, and the other half can be done in the same way, the pipes running alongside the first pair. An even better plan is to run the first pair of pipes, in the manner just described, half way round the room, and return from there back to the boiler, then run the other pair the other way. This will provide one complete circulation doing one half of the room and another circulation doing the other half of the room. Both these methods will require two flow and two return connections on the boiler, and, if quick results are desired, such connections must be provided, because the quantity of large pipe to be heated is considerable. Other methods are to take a flow from the boiler, and, with a suitable fitting, make four pipes and carry them all round, ending in the boiler; but whether all four pipes would heat successfully is very doubtful. Another plan would be to start with one 4-in. pipe, convert this into two pipes, carry these all round, but, instead of letting them then enter the boiler, put syphon ends and run the pipes all the way back again before they join the boiler. With this plan the returns would not be very hot after travelling so far, and would be of small use as heating surface.

Gas Pressure Gauge.—To make a gas pressure gauge that can be attached to acetylene or other gas burners, obtain a piece of ¼-in. or ⅜-in. glass tube and bend it U shape; this can be done in a gas flame, for preference a Bunsen flame, as it is smokeless. Fix the tube on a piece of board in the manner shown, and at a suitable point draw a zero line and mark it 0. Above this draw lines every *half-inch* and mark them as illustrated: each of these will indicate one-inch pressure, because the water level in one leg of the U drops while the other rises, and the pressure is counted by the measurement between the two water levels. In the illustration the pressure is shown at 3-in.,



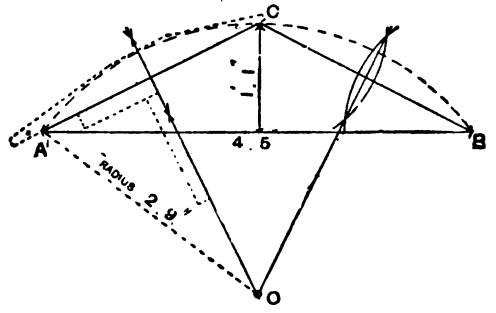
Gas Pressure Gauge.

because the water levels are three half-inches above and three below zero. The thick black part is the water, which may be plain or coloured. The taps shown are not needed for pressure testing at a bracket, as the bracket tap answers, but a gauge made in this way serves another very useful purpose, as in the case of an installation of acetylene it can be made to indicate leakage, and for this the cocks are used. Attach the lower cock to any branch or bracket (by a flexible tube will do, though not every piece of rubber pipe is acetylene-proof) and open this tap. Shut the main cock at the generator and all other taps. Now blow into the upper tap until a 14-in. to 16-in. pressure is indicated, and then close this tap. If the water level stands at this height, or close on it, for half an hour the piping may be passed as sound. It is very desirable to test the piping of an acetylene apparatus, as acetylene is a very searching gas, passing through a leak where coal gas would not go. Leakages are located by brushing soap-suds on suspected places, the leaking gas then blowing a bubble.

Paints free from Whitelead.—The ingredients are: zinc white 50 parts, pale boiled linseed oil 7 parts, pale copal varnish 2 parts, American turpentine 3 parts; mix well together and apply two coats, following with a coat of colourless copal varnish. This is a durable white paint which may be used with advantage as a substitute for white-lead, and is non-poisonous. A cream colour may be obtained by adding 1 oz. of Italian ochre to every 14 lb. of the above. A non-poisonous olive green may be prepared by mixing well together zinc white 14 parts, yellow ochre 3 parts, ivory black 1 part, boiled oil 4 parts, American turpentine 1 part, oak varnish 1 part; apply two coats, and finish with best outside oak varnish.

Gumming Envelopes.—Gum arabic when used for envelopes is dissolved in water and strained through muslin or a very fine hair sieve. It is not necessary to let the gum stand—in fact, it should always be used as fresh as possible. Gum standing for any length of time will take up impurities from the atmosphere. A flat camel-hair brush is best for applying the gum to hand-made envelopes. The envelopes are laid on the bench and "fanned out" or spread out a number at a time, and the brush, well charged with gum, is drawn lightly over them while being held in position with the left hand. They are then carefully spread out on a board and left to dry.

Striking Segmental Arches.—In striking segmental arches, if the measurements are to be taken from the actual openings, the rise may be ascertained either by holding a straightedge to the springings and measuring with the rule the amount of rise at the middle, or a rod may be cut square at one end, and this end rested either on the sill or the floor as the case may be, and the height of the springing, or point where the arch starts, marked upon the rod, and also the height of the crown or middle of the opening; then the difference between the two heights will be the amount of rise. To ascertain the radius of any segment, when the span and rise are known, proceed as follows. Draw a straight line A B (see illustration) equal in length to the required span (in the instance given this is shown as 4ft. 5in.); at the middle of this line and at right angles to it draw another line equal to the rise at C, which is 1ft. 1in.; join the ends of these lines by other two lines A C, B C; bisect these lines, and the intersection of the bisectors will be the centre of the required segment. In the case of large segments to be set out in the workshop, the method of finding the length of the radius rod is shown on the left of the illustration; proceed as before to lay off on two lines at right angles to each other the rise and span, drive in three nails at points A, C, B, and rest a straightedge against the nails as shown by the dotted outline, measure with the rule the exact centre between A and C on the straightedge, and at this point hold the edge of a carpenter's large square, marking its edge on the floor or board; repeat the process on the other side and produce the lines until they meet in the point O, and the distance from O to A or O to B is the required radius (in the given case 2ft. 9in.).

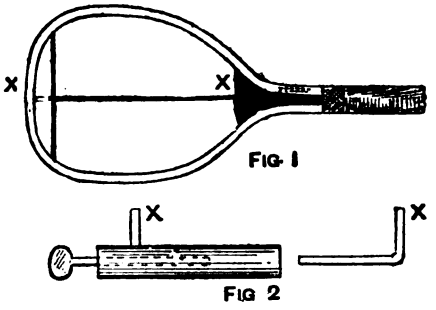


Striking Segmental Arches.

Defective Tone in Clarionet.—If a clarionet becomes husky and unpleasant in tone after being played on for a few minutes, it may be that the reed, being just stiff enough at starting, becomes less elastic as it gets warm and saturated with moisture. The remedy would be to substitute a reed somewhat stiffer, that would retain its spring even when moist and warm. Reeds will not last for ever, and some are soon rendered useless. Or the mouthpiece may be of unseasoned wood, or the face not square to the grain; or the wood, if laid when dry, will, when wet, alter sufficiently to make the bedding of the reed different in condition from what it was when playing began. In this case the remedy is to insert a new mouthpiece or to relay the present one when moist after playing. It is imperative that the curvature of a clarionet mouthpiece should be equal on each side of the aperture, and not "in winding."

Preventing Rust on Cycle Frames.—Dealers and users of cycles are often troubled with spots of rust on the enamelled parts, for even carefully stoved new machines will often break out in rust spots all over the frames. The weldless steel tubes now employed are so porous as to allow damp and rust to strike through from the inside; secondly, much of the enamel now used allows damp to strike through to the frames from outside; and in the third place, the priming now in use is defective as a protection against damp, and consequent rust. In some experiments a steel tube was covered with three coats of Mander's priming, and then half of the tube was painted with a paint composed of white-lead, polishing copal varnish, and turpentine; the tube was then baked for three hours at 320° F., and hung in a room where the atmosphere was exceedingly damp. In two months' time the part that was only covered with the priming was a mass of rust, the priming having practically disappeared; but on the painted portion there was not the slightest sign of rust even down to the extreme edge, and on scraping this coating off, the tube was perfectly bright underneath. The white-lead, varnish, and turpentine mixture will stand the necessary stoving perfectly.

Restringing Tennis Racket.—Gut for restringing tennis bats must not be wetted or even damped with hot or cold water to make it pliable, or it will be spoiled. To restring a racket, cut out the old gut, pick out all pieces from the holes and grooves, and well wipe round the frame with a French chalk rag. Get a couple of awls in handles, and push one through the holes to clear them. Gut may be bought in 18-ft. lengths, and a full-size tennis bat takes two such hanks. Hook a hank on a ring and, holding it in the hand firmly, undo it gently without knots. Put the centre on the hook or handle and get hold of each end and walk backwards, stretching the gut, and if no knots or kinks are in, pull it tight; this makes it pliable. Count the holes round the racket and find the centre two at the top. Start in these so as to work half of the racket at a time, and thread through and through till the two ends come off to a finish. Lift the loop outside the racket and put the ends through. After the main gut is in and the ends under several of the loops are down, the racket must be tightened up. To do this is a very difficult job, because if a support is not put in the bat (see Fig. 1), pulling on the gut string to bring the slack through will pull down the top of the bat. To prevent this a tool in two pieces (Fig. 2) is used, one piece fitting in the other. The plug when in place butts against a thumbscrew, by which it is adjusted to any length. When this support is put in, the cross string can be started in the top side at a V or W shaped groove. Trace over and under each main string, but see that the right hole is worked when the gut comes out on the other side so as to drop in the channel or groove that is made to receive it. Pull on each string and wedge it by a smooth pointed awl in the hole where the gut is being held. Two awls are wanted so as to keep one string tight while pulling on the other. When the cross strings are nearly done the support X X (Figs. 1 and 2) should fall out, proving that the racket is of about the same shape as it was before being worked.



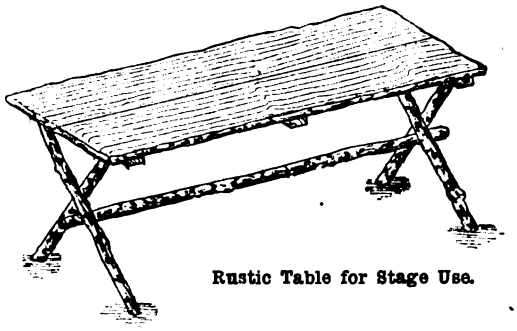
Restringing Tennis Racket.

Water Freezing in Outdoor Cistern.—To protect the contents of cisterns situated in outdoor attached buildings from freezing, the cisterns should be boxed round with timber and the intervening space carefully packed with sawdust or slag wool. The pipes leading up to the cistern should be wrapped round with brattice cloth; another method is to lay the pipes between two grooved pieces of timber, say 3in. by 1½ in., somewhat in the manner that electric wires are laid in a wood groove. If only the cistern is affected, a lamp might be kept burning near the cistern while the weather is severe. Another method (but one that is unfair to the water company) is to place a weight upon the ball of the ball tap, and thus the water is kept running.

Enamelling Cycle Aluminium Colour.—The best way to enamel a frame in aluminium colour is to coat the frame with japanner's gold-size to which has been added a little stoving varnish. Stove until tacky, and rub over with aluminium powder. Then stove until hard. Give a coat of good stoving varnish, and again stove. The best way to harden aluminium paint which has dried without heat would be to apply a coat of good copal varnish and put the cycle away in a place free from dust until thoroughly dry.

Fancy Shading on Marble Paper.—Fancy Spanish marble papers are all produced on gum dragon alone; in fact, there is no better medium for the purpose. It is impossible to describe the exact method by which any particular effects are produced, as they are all more or less the results of dodges worked by each individual workman. In some instances the sheet of paper, instead of being kept flat when marbling, is folded with a number of creases crossing each other, producing irregular waves, so to speak, in the paper. Again, a wooden frame, made of thin laths, may be made in regular squares or broken up so as to make circles or ovals. The paper to be marbled is damped and laid on the frame, and when being dipped the size forces some parts of the paper upwards, and when the ordinary wave-like motion, as when producing common Spanish marbling, is given to the frame, irregular waves or shading are imparted to the design on the paper.

Rustic Table for Stage Use.—The illustration shows a rustic table for stage use, the top of the table being formed of two pieces of 9-in. by 1-in. wood 4 ft. long,



Rustic Table for Stage Use.

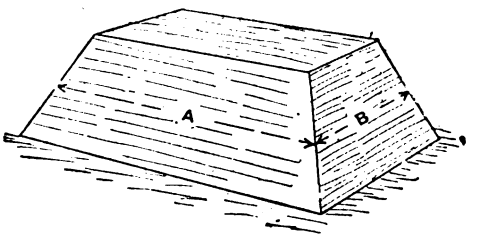
fixed together underneath by three battens 1 in. by 2 in. by 1 ft. 6 in. long. One batten is screwed in the centre and the others at 2 in. from the ends. The legs and cross-pieces are made from light tree branches. Round the edge of the table nail some smaller stuff or some strips of virgin cork. A suitable paint for the table can be made by mixing 1 lb. of raw umber in powder with some hot size or liquid glue.

Darkening Oak Fretwork.—For darkening a fretwork overmantel made of oak without destroying the figure, a bichromate stain is used. Dissolve one pennyworth of bichromate of potash in 1 pt. of rainwater, then brush the article all over with raw linseed oil, using a painter's sash tool to ensure getting it well into all interstices. Now dip the same brush into the potash solution, brush the stain well in, and whilst still wet rub down with No. 0 glasspaper to cut down any apparent roughness. Brush over with the stain again, and wipe off any surplus with a rag. Excess of oil and stain should be avoided, and to counteract any tendency to twisting treat both sides alike. The above stain may be applied several times, and will impart an appearance of pollard oak. Should a still darker tone be required, use permanganate of potash instead of bichromate. During the operations it is a good plan to have the work apart, and laid down on a newspaper.

Taking Casts of Footprints.—Ordinary plaster would be found to make a suitable cast of a footprint. The plaster should be gauged fairly thin, so as not to disturb any peculiar markings, and gently poured over the footprint, blowing the plaster into every crevice. When completely covered, as much extra plaster may be added as will give the necessary strength to the cast. Give the mould a thin coat of oil, paraffin will do, before applying the plaster, so that the cast may be easily freed from the mould. If the brushing-on of the oil is calculated to derange or damage the mould, the cast may be taken without it, only, in this case, the original footprint will be destroyed when freeing it from the plaster. If plaster is not handy, wax might be tried. Gently melt down a few wax candles and, when cool, but before becoming hard, apply in the same way as plaster. This will make a cast that would be very easily destroyed or damaged, but, when the cast has once been obtained, it is a simple matter to make from it a plaster mould and recast it in plaster, or merely take a clay impression.

Lining Cask with Pitch.—A cask whose inside is to be coated with pitch should be made very hot by placing a small fire basket inside it. If the cask formerly contained turpentine or other inflammable liquid, care must be taken in heating the cask that the turpentine does not catch fire, as if it does the cask would probably be consumed. The pitch should be heated in an iron pot (care in heating is required, and the process should not be done in a house to prevent it catching fire) and then poured into the cask, which should be rolled round so that the pitch will flow over the whole of the surface. If the cask is to stand outside and hold rainwater, its outside can have three or four coats of ordinary oil paint.

Measurement and Weight of Coal Banks.—For ascertaining the approximate weight of coal stacked in banks with sloping sides and shaped as shown by the accompanying sketch, measure the length on a line taken halfway up A and the width on a line halfway up B and multiply one measurement by the other; then multiply the result by the vertical height, which may be obtained by placing a straightedge on the top to overhang one side and dropping a plumbline to the ground. For instance, suppose A to be 40 ft., B 20 ft., and the height 5 ft., $40 \times 20 \times 5 = 4{,}000$. Now to get the tonnage, divide by 40 for average coal, which would give 100 tons. When the heaps are not rectangular, take the average; for instance, suppose A to be 100 ft. and the side opposite 80 ft., then the average, obtained by adding 100 and 80 together, and dividing by 2, would



Measurement of Coal Banks.

be 90; the average width or height would be obtained in a similar manner. As coal varies considerably in weight, it is necessary to weigh trial lots from each colliery; this may be accomplished by finding the cubical contents of the coal waggons and dividing by the load after deducting the tare of the vehicles. It must be borne in mind that coal deteriorates both in weight and heating properties by being stacked in the open air for any length of time, and there is also a loss if the heap is weighed and removed in small quantities, but as these losses vary so considerably, according to the different conditions, it is not possible to state the percentage that should be allowed.

Acetylene compared with Incandescent Gas.—Acetylene gives a more natural light (that is, more nearly approaches daylight) than coal gas, and for this reason acetylene may, in a shop, be preferable to coal gas. But coal gas is much the cheaper, even allowing for new mantles, say four times a year. Light for light, as regards illumination, the cost of acetylene is equivalent to coal gas at 3s. to 3s. 6d. per thousand if Bray's burners are used. When mantles are employed, the illuminating qualities of coal gas are so greatly improved (no additional gas being used) that the same illumination with acetylene gas would amount to nearly double the cost of coal gas, provided of course that the mantle burners are not covered with opal or other globes which reduce the light. When opal globes are used the cost of the two illuminants is more nearly equal. Another important consideration is that acetylene must be made on the premises; this involves a certain amount of trouble, though not much with a good generator. Added to this is the cost of the acetylene apparatus, and interest on this outlay should be calculated in the cost of the gas. Briefly, acetylene is quite practicable for a shop and affords a very pleasing light, but very few people in London, where coal gas is cheap and good, would abandon it for acetylene. In country houses, and in many villages, acetylene is superior to every other kind of artificial light; but in large cities coal gas is the cheaper light.

Determining Height of Cone for Ventilating Pipe.—The rule for determining the height of a rain-protecting cone above the top of a ventilating pipe is that the area of the cylindrical space between the base of the cone and the top of the pipe should be equal to the area of a circular section of the pipe. Thus, assuming the ventilating pipe to be 10 in. in diameter, then $10 \times 10 \times \cdot 78$ equals 78 sq. in., the area of the end of the pipe. The circumference of the pipe is $10 \times 3\frac{1}{7} = 31\frac{3}{7}$ in. nearly. Dividing the area of the end of the pipe by the circumference $(78 \div 31\frac{3}{7})$ equals $2\frac{1}{2}$ in. nearly. This would be the height at which the cone should be placed above the cylinder. A cone 6 in. larger in diameter than the pipe should be sufficient to prevent rain blowing down, and above and below a 10-in. pipe the size would be increased or decreased about $\frac{1}{4}$ in. in diameter for the cone for each difference of 1 in. in the pipe.

Picker-up for Table Tennis Balls.—A picker-up for table tennis balls is constructed very simply. It consists of a light cane or stick A (Fig. 1) about 3 ft. in length, attached to a cylindrical tube of cardboard by a band of sheet-brass B so that the shank when fixed to the tube makes an angle of about 60° with the horizontal. The tube C is about 2 in. long and about $\frac{1}{16}$ in. thick, and must have an internal diameter of $1\frac{1}{8}$ in. About $\frac{1}{4}$ in. from the bottom of the tube, and at equal intervals around its circumference, are made six holes about $\frac{1}{4}$ in. in diameter, and through these holes is threaded a piece of the narrowest flat elastic D, and the ends are knotted together. The elastic thus forms roughly

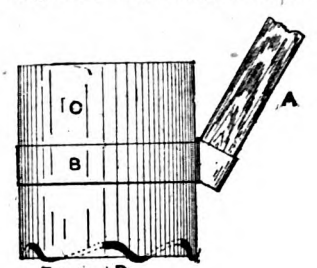


FIG. 1 FIG. 2

Picker-up for Table Tennis Balls.

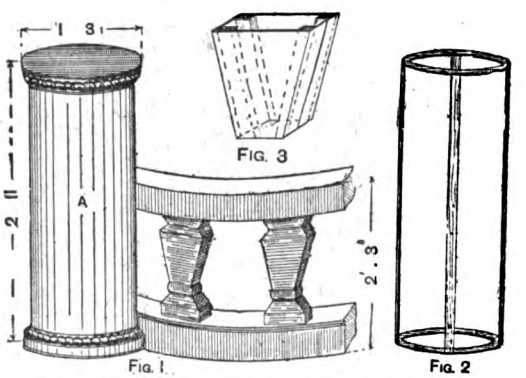
a hexagon inscribed in the bottom of the tube, as in Fig. 2, and acts as a grip when the appliance is pressed on the ball, allowing the ball to pass into the tube but preventing it falling out.

Blisters on Bromide Paper.—Blisters on photographic bromide paper very probably are caused by the uneven temperature of the solutions. The fixing bath should be made with warm water, as hypo becomes very cold while it is dissolving. All baths used in developing, fixing, toning, or washing should be kept as nearly as possible at 60° F. Prints that have blistered should be placed in methylated spirit, which destroys the blisters by causing the film to contract.

Hottest Point in Hot-water Apparatus.—Before the fire below the boiler is lighted, the water may be assumed to be of the same temperature throughout the apparatus. As soon as the fire is lighted, heated water begins to leave the boiler and passes up the flow-pipe; this shows conclusively that the hottest water is in the boiler. The case could not indeed be otherwise, for the boiler is the place at which the heat and the water are in juxtaposition. While the fire is kept going, the hottest point in the apparatus is the flow-pipe, tested as near to the boiler as possible, and obviously the boiler is still ahead of the flow-pipe in temperature until all the water arrives at the boiling point, or until water is drawn from the taps. When the fire is let down or goes out, the heated water will gradually work its way up to the highest point in the apparatus at which circulation is possible, and the boiler will contain the coolest water until all the water is cool or until the fire is started again. Nevertheless, when a boiler is heating up, it contains both the hottest and the coolest water. The hottest water leaves by way of the flow-pipe, but at the same moment the coolest water is entering the boiler by the return pipe. Heat is certainly lost from the flow-pipe unless it is well covered with some poor heat-conducting material. Such a covering is very seldom provided, and a practical observer always wonders why so much fuel and trouble are expended in heating the boiler and so little care is taken to prevent dissipation of heat by unprotected hot pipes and tank, etc.

Removing Shininess from Black Cloth.—To renovate some black clothes that have worn shiny, it is necessary to spread the garments to be renovated on a plain press-board or table. Dissolve a little ammonia in hot water; in this dip one end of a stiff brush and work it vigorously over the affected parts. This is best done by a jobbing tailor, but even when the renovation is carried out at home the garments should be sent to a tailor to be pressed. It should be said that when the "shine" is due to unusually long and severe wear the surface will have been worn beyond recovery, and no useful purpose will be served by the treatment that is described above.

Balustrade and Pedestal for Photographic Studio.—Such articles as a balustrade and pedestal (Fig. 1), to be used as studio accessories in portrait photography, usually consist of a wooden framework, over which the ornamental part, generally made of moulded paper pulp, is fixed with glue; the whole is then coated with a mixture of whiting, lampblack, and size. The accompanying illustrations will serve as a rough guide, but the maker of the article may of course vary the design to suit his taste. Figs. 2 and 3 show the method of building up the balustrade. The circular



Balustrade and Pedestal for Photographic Studio.

pillar is made by winding good stout card around two hoops and laths as shown in Fig. 2; over this is moulded the pulp for the carving. The smaller pillars are made by glueing card round four stout pieces of wood; the other portions are cut and bent into shape in a like manner.

Filling-up Bodies in Coachmaking.—For filling-up woodwork some coachmakers use spruce ochre ground fine in turpentine, whilst others prefer to use the Grafton filling-up powder, which is made of finely powdered shale and slate. If spruce ochre is used, to about 4 lb. add about $1\frac{1}{4}$ lb. of tub white-lead; this softens the ochre, and produces a closer surface; then add a small quantity of raw linseed oil, and the drainings of varnish cans, japan gold-size, and black japan, thinning the mixture to a cream consistency. The Grafton filling is mixed in much the same manner; thus, to a given weight of powder add from one-third to one-half the weight of tub white-lead, well incorporated with turpentine on the grinding-stone. Use a palette-knife for mixing. The body should first have three coats of light lead colour, and when it is dry and hard the filling-up is put on, one coat being applied each day, and successive coats being laid off in opposite directions. Six coats of filling are generally put on, but an extra coat is never wasted on a body. When the filling is hard, after standing a week or longer, a coat of Indian red or rose pink is put on as a guide coat when rubbing down. This is done with a level pumicestone and water. These, a sponge and chamois leather, and a No. 6 water tool to get the pumice dust out of the corners, beads, and quirks, are all the appliances required in rubbing down a body.

Polishing Briar-root Pipe.—Briar-root pipes often are oil polished, being wiped over with linseed oil, and polished by holding against revolving discs or a buff made of several layers of chamois leather. A steel burnisher is sometimes used. Ordinary French polish is unsuitable for pipes likely to get hot by smoking. One ounce of seed lac dissolved in 1 gill of methylated spirit and applied by a small piece of chamois will give a shine that can easily be renewed as required. A trace of linseed oil applied at the same time as the solution will enable it to be spread more evenly.

Skeleton Sign Frame.—Figs. 1 to 3 show a skeleton sign frame 6 ft. 6 in. long on each side by 3 ft. high, to take 10-in. by 6-in. wood letters. To make the frame, procure eight pieces of ¾-in. gas barrel, 6 ft. 4 in. long, screwed at each end, four cross pieces, and four T pieces; one end of each barrel should be heated and bent as shown and screwed into the cross pieces. On the other end of the two intermediates screw the T pieces. The top and bottom rails will require an angle piece at each end. The centre pillar is built up with short pieces of barrel, each 10½ in. long, connecting the cross pieces. Each wall pillar will be in one length, composed of a piece of round iron running through the two T pieces on intermediate rails and into the angle piece at each end. A hole is drilled through each piece and through the iron rod,

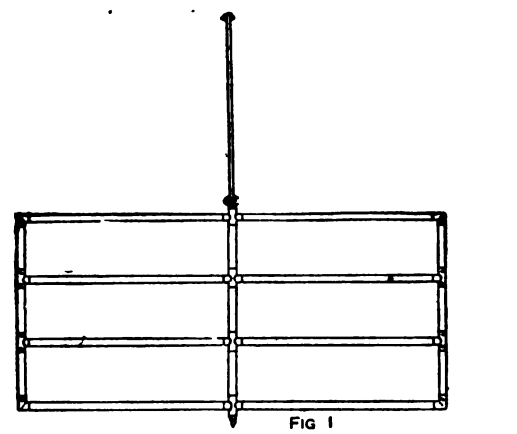


FIG 1

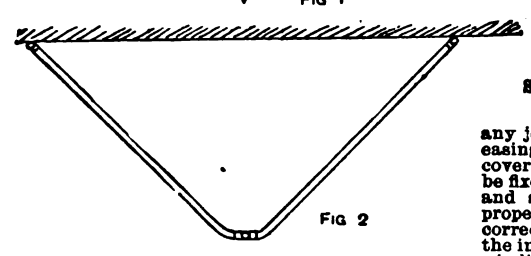


FIG 2

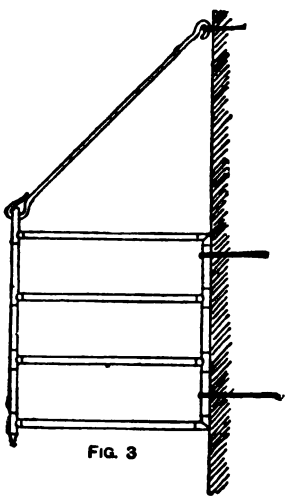


FIG. 3

Skeleton Sign Frame.

which is fixed by a pin. Into the cross pieces at the top of the centre pillar is screwed an iron ring; the frame is fixed to the wall with four wall hooks driven in and clasping the pillar. As additional support is needed in the centre, the frame is suspended by a ¾-in. round wrought-iron rod, with a hook at each end; one end is fastened through the ring at the top of the centre pillar, and the other end through a ring driven into the wall. The wood letters are fixed at the top end with wrought-iron plates to iron rails, and are allowed to swing, or they may be fixed permanently on wire frames, which are in turn secured to the frame already described. Figs. 1 and 3 are elevations and Fig. 2 a plan of the frame.

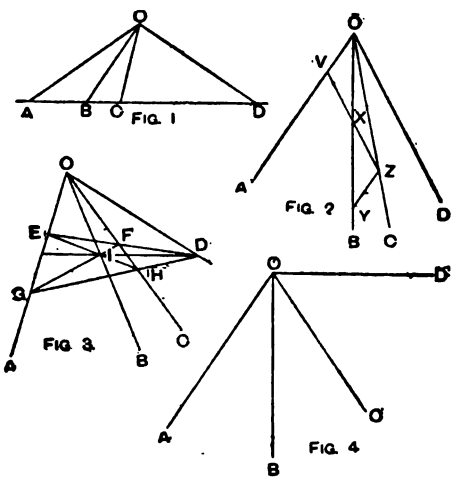
Trouble with Chimney.—It sometimes happens that when a fire is lighted in one room of a house, smoke is discovered coming out at the fireplaces of other rooms. In a new house the trouble can scarcely be due to defective brickwork; and even when in old buildings the sweep has knocked out a brick or a half-brick between two chimneys, the effect is seldom to cause smoke to rush out in the manner described. A simple experiment, however, that will prove whether a chimney is sound may easily be tried. Light a fire in the grate of the suspected chimney and then put a sack over the chimney top; if the smoke comes out at any unexpected place the defect will be at or near that place. More probably, however, the trouble will be found to be due to down-blow, for the smoke of one chimney is frequently driven down a neighbouring chimney if the latter is at the time without a fire. If the chimney is accessible, an experiment, to determine whether down-blow is the cause of the trouble, can be tried by putting a piece of pipe on to a bedroom chimney not in use at the time; for a simple test a cardboard pipe about 36 in. high could be used. If down-blow is the cause, then probably the trouble only occurs when the wind is in certain quarters. If the smoke comes into the bedroom (the parlour fire being alight) without regard to wind or weather, then the trouble may be syphonage, which is the drawing of air down one chimney by the superior up-current in another chimney, the normal air supply being insufficient for both chimneys. Syphonage is of rare occurrence in cottages, though common in very large buildings.

Finishing English Lever Watches.—Roughly the process of finishing a ¾-plate English lever watch is as described below. The wheels are first pivoted, and the depths pitched accurately. The centre-wheel holes and fourth-wheel holes are taken as correct in the rough movement, and the barrel and the third wheel are pitched to suit them. When the wheels are run in the plates, the frame goes to a watch jeweller for any jewel holes that may be required. The barrel needs easing in its pivot holes, the inside of the bottom and cover must be stoned smooth, a mainspring hook should be fixed, and the stopwork must be made to work easily and smoothly. The set-hand work is made to work properly, and the motion work turned to fit and run correctly. The balance cock is sent to be engraved, and the index and hairspring stud are made and fitted. The winding squares are reduced in length and polished. All the screws are hardened, tempered, polished, and blued. The plates and cocks are stoned up, sent for any engraving they need, and then forwarded to the gilder. If the plates are to "be spotted," they are done in a spotting tool. This consists of an upright spindle which is revolved by a foot wheel or by a bow; it carries a small ivory tube, like a drill, underneath which is a movable table to which the watch plate is fixed. This table has two motions, worked by screws like a lathe slide-rest. The plate is first polished, then smeared all over with a thin paste of oilstone dust and oil and placed on the tool. The spindle with the ivory tube is revolved and made to touch the plate for a moment; the plate is then moved one division by the screws, and the process repeated until the complete pattern is made.

Mending Umbrella Tube.—A steel umbrella tube broken at the notch should have a new tube. However, to repair, remove the tube from the frame, then get a piece of round iron rod about 3 in. long and of such a diameter as will tightly fit the inside of the tube. If the tube is a thick one, possibly a piece of an old thin tube may be procured that will fit. Push about 1½ in. of this dowel piece inside the tube and put a fine rivet right through, then fix on the end piece in the same way. The notch will best be refixed by soldering, as drilling a hole in the tube will weaken it.

Silver-plating Paste.—Cheap silver-plating pastes and powders are useless and really harmful; they are generally made from mercury compounds, and the mercury amalgamates with the metal on which the paste is spread; then in a few days the bright surface becomes tarnished and the metal becomes honeycombed and dull. The best material to use is a silver compound. A silver-plating powder may be made by mixing together with a little water 1 oz. of chloride of silver, 3 oz. of common salt, and 2 oz. of cream of tartar; this should be rubbed on the articles to be plated. If this preparation is too expensive, a silver bronze paint could be used; this could be made by rubbing up aluminium powder with sufficient pale copal varnish to form a stiff paste and thinning out with turpentine.

Harmonic Pencils.—The harmonic pencil cuts any transversal A D (Fig. 1) harmonically; that is, A B : A D :: A C − A B : A D − A C, which can be seen by a simple measurement, as A B is one-fourth of A D. Let O A, O B, O C, three rays of a harmonic pencil, be given (Fig. 2); it is required to find the fourth. Take X, any point in O B, and make X Y equal to O X. Draw Y Z parallel to O A, and Z X produced to V through X. Then V Z is bisected at X. Draw O D parallel to V Z. This is the fourth ray. This method depends on the fact that if a line is bisected by a ray, it is parallel to the conjugate of that ray. (Alternate rays are conjugate to one another.) A second method is as follows (Fig. 3). Given O A, O B, O C, as



Harmonic Pencils.

before, draw any line E F and produce it. Take any point I in O B, and draw F I G and E I H. Draw through G H to meet E F in D. Then O D is the fourth ray. The proof is this. Take a quadrilateral, as E F G H. Draw the diagonals, which intersect in I. Produce the opposite sides to meet in O and D. Join O D, O I, and D I. Then the pencils which radiate from O X and O are both harmonic. If O B bisects the angle A O C, O D is at right angles to O C (Fig. 4).

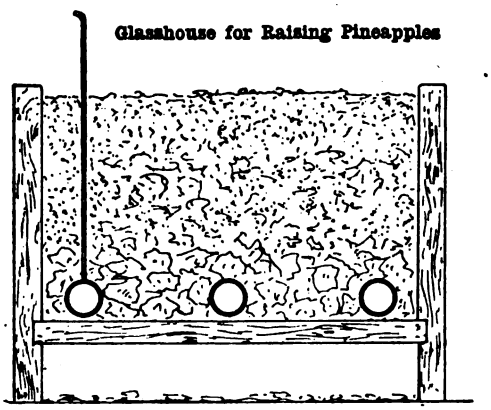
Groyne.—A groyne is a wall or breakwater built on the sea-beach, extending from high-water mark towards low water, and serves to prevent the sea washing away the land. The groyne achieves this purpose by preventing the travel or drift of the sand or stone that forms the shore. The Case groyne is made of timber, and the theory of the inventor of this form of groyne was that the work would be better done if done by slow degrees. This groyne is made only a foot or two high at first, and when the sand or gravel has been accumulated to the full height of the groyne another foot or so is added. This theory has been found to be correct, and as a consequence the Case groyne is now nearly always used to prevent the sea making inroads.

Cresylic and Salicylic Acids.—Cresylic acid (C_7H_8O) is a colourless liquid substance principally found in coal and in the products of coal-tar, and also it is found in firwood tar; on repeated distillation cresylic acid yields phenol (carbolic acid). Nitric acid acts upon cresylic acid, forming nitro-cresylic acid. A considerable quantity of cresylic acid is employed in the manufacture of salicylic acid, which, possessing several advantages over cresylic acid, has superseded it for all the purposes for which cresylic acid was formerly used. The addition of a little salicylic acid renders all kinds of glues very tenacious and prevents decomposition, this property being taken advantage of by manufacturers of distemper. Salicylic acid is quite colourless and free from taste or smell, and is considered to be three times more powerful than carbolic acid in preventing putrefaction. Skins that are to be used for making leather do not undergo decomposition if treated with dilute salicylic acid. Salicylic acid is poisonous in quantities.

Blisters on Pneumatic Tyres.—Dirt between rubber and canvas causes blisters or swellings. To remove them, hook a piece of wire, push it through the rubber, and scrape out the dirt. Put some rubber solution in through the hole, and work round with the wire. When dry, press the rubber down to the canvas while inflated.

Glasshouse for Raising Pineapples.—For growing pineapples in artificial heat practically any shape and size of greenhouse will be suitable, provided it can be kept hot enough. A broad lean-to kind is the best, as its side wall can be put to face the north and thus save anxiety when the cold gales are on, for the pineapple is very delicate and susceptible to the least fall in temperature. A pine house should have other glasshouses at each end to shelter it and so that its doors may not open to the outer air. A temperature of 80° F. is required, and to obtain this there must be 75-ft. to 80-ft. run of 4-in. pipe to each 1,000 cub. ft. capacity in the house. An exposed situation may require 85 ft., while for a naturally warm situation 70 ft. per 1,000 cub. ft. might suffice. Pines are raised in "pits." These are beds resembling huge wooden troughs raised off the ground a little. These pits vary from 2 ft. to 5 ft. wide, and may be as long as desired. They have to be heated, independently of the house, by pipes run along in the bottoms of the beds as shown by the illustration, which is an end section of a bed. Two 4-in. pipes are enough for a 3-ft. bed, while three 4-in. pipes would be required for a 4-ft. bed. The pipes are covered with clinker or broken brick, then comes a layer of smaller stuff, then the earth above. The rough material drains the bed and prevents the earth getting round the pipes. Some beds have the pipes underneath the bottom, while others have a long brick-built tank underneath, and the pipes are run through this. It is also a good plan to let one of the house pipes run round the top edge of the pit. The degree of humidity is a matter for the grower to decide. The moisture is obtained either by running one or two pipes through a long trough of water, or trough pipes are used. The latter are pipes with troughs cast on them. Or loose troughs to lie on top of the ordinary pipes can be had from all pipe factors, or zinc troughs can be made.

Glasshouse for Raising Pineapples

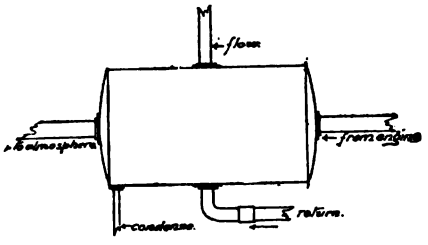


Walnut Varnish Stain.—For a walnut varnish stain, agitate 1 pt. of methylated spirit and 3 oz. of orange shellac in a well-stoppered bottle at intervals until thoroughly dissolved; then add ½ oz. of Bismarck brown and ½ oz. of nigrosin, stir well, and pass through a fine strainer, when the stain is ready for use. By varying the proportions of the colouring matter any shade of oak or walnut may be prepared. In reply to a further question, oil is not used in spirit varnish, the medium employed for thinning down being methylated spirit. The stickiness complained of is due to the varnish being too thick. The varnish should be applied quickly and evenly in a warm atmosphere, using a wide camel-hair or sable brush

Naphtha Varnish.—Wood naphtha or crude wood spirit is very little used in spirit varnishes on account of its complex composition. To prepare a varnish from wood naphtha, place 1 gal. of naphtha in a well-stoppered vessel with 2 lb. of bleached shellac, and dissolve by frequent agitation; allow to stand for fourteen days, when the varnish will be ready for use. By adding aniline dyes soluble in spirit, the varnish may be converted into mahogany, walnut, and other stains. The above preparation will be found to evaporate very quickly, and therefore it should be kept in an air-tight vessel in a cool place.

Sugar Candy.—Sugar candy is prepared from a saturated solution of sugar, formed by adding sugar to boiling water till it will dissolve no more. The solution is then run into troughs, in which it is allowed to cool slowly, while a number of threads are hung in the liquid upon which the crystals form, and continue to grow. The time required will depend on the bulk of sugar treated. In working on a small scale, it will be necessary to remove the strings and adhering crystals; then add more sugar to the liquid, boil up, and immerse the strings again while the liquid is cooling. Cakes of candy will also separate on the sides of the vessel in which the liquid cools.

Heating Water by Exhaust Steam. — To utilise exhaust steam from a 12-horse-power engine to heat the water of a hot-water circulating system which is at present heated by a boiler in the usual way, either the water could be heated by the steam alone or the steam could be made to assist the present ordinary boiler. The method to be adopted is that by which feed-water is heated, and a modified form of feed-water heater is suggested. A cylinder with a set of tubes in it is the best heater for the purpose, the steam being either outside or inside the tubes, whichever arrangement appears better



Heating Water by Exhaust Steam.

If it can be arranged, it is best to let the exhaust blow straight through the heater, but it should first go through a "separator," which removes the oil. In summer-time there should be a means for the exhaust to escape without going through the heater. The heater must have a condense pipe from it terminating in a trap. The accompanying sketch shows these details. The flow and return water pipes only require to be joined up to the existing mains, flow to flow and return to return. There should be a safety-valve on the water part of the heater.

Black Cream for Boots.—For a black cream for box calf boots, mix 1 lb. of curd soap, 2 lb. of beeswax, 2 lb. of oil of turpentine, and 4¼ pt. of water, with black or any colouring matter to the shade required. Cut up the soap, and dissolve in water by boiling separately; dissolve the wax in the turps by heating the two together, pour into the soap solution, and briskly stir until the whole is cool and creamy. Aniline colours, if required, should be mixed with the water before the soap is added.

Cleaning Geneva and Waterbury Watches.—All watches are cleaned by being taken to pieces, the parts being immersed in benzine for a few minutes to dissolve the old oil, etc. They are then held separately in tissue paper in the fingers (to avoid handling) and brushed clean and dry with a soft "watch brush" rubbed in dry chalk. All pivot holes, etc., are thoroughly cleaned out with a sharp-pointed peg of wood (sold in bundles as watch "peg wood"). To clean jewel holes that have endstones, the endstones are taken off before pegging the holes. Before taking any watch to pieces, the mainspring must be let down by holding up the winding click and allowing the spring to run back by means of a key placed on the winding square or by the winding button. While taking to pieces, look carefully for faults, such as worn pivots, wide pivot-holes, signs of wheels rubbing on the plate or against each other, etc., with a view to correcting them before putting together again. In a Geneva watch escapement the cylinder must be of such a height that the 'scape wheel enters the slot or passage cut for it without touching either the top or the bottom. The depth must be sufficient just to allow the 'scape-wheel teeth to "lock." The watch should be accurately "in beat"—that is, when the balance is at rest, the cylinder opening should face the 'scape wheel exactly. A Waterbury is a duplex watch, and is in beat if, when the balance is at rest, the impulse-pin points to the 'scape wheel. Oil should be placed in small quantities on mainsprings, on all pivots, on keyless wheels and springs, and on the points of 'scape-wheel teeth.

Binding Books Without Special Tools.—For binding books without special tools all the materials that need be provided are a little melted glue, some paste, a needle and stout thread, some white and coloured papers, and a few other trifling items. Arrange the sheets to be bound in order, beat them even at the back and head, and subject them to a heavy pressure between two flat surfaces by piling weights on them. Now take two pieces of tape ½ in. wide, and each 2 in. longer than the width of the back of the book. Stiffen the tape by drawing it through paste, and then let it dry before use. Fold the pieces of stiff tape, and place the sheets within them in such a position that the two tapes A (Fig. 1) will divide the back into three equal lengths. While the sheets are pressed down firmly with the left hand, with a lead pencil draw a line down each side of the tapes, and two other lines, each one dividing that part of the back outside the tapes into equal portions. These lines mark the place for the entrance of the needle. The sheets are to be sewn on the tapes as in Fig. 1. When the book is sewn, the threads fastening each sheet are seen outside the tapes. The back must now receive a coating of glue, not too thin, after which it may be left to dry. Then, the glue being hard, the book may be cut on the edges with a straightedge and a sharp knife. The back must next be rounded by tapping with a hammer, which may be

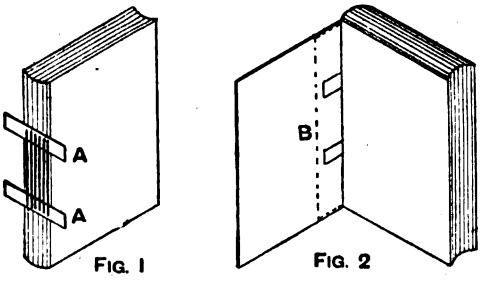


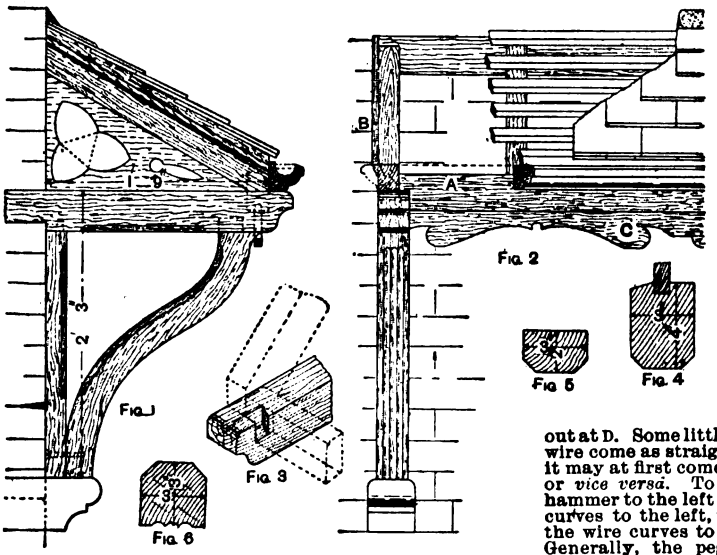
FIG. 1 FIG. 2

Binding Books without Special Tools.

helped by a gentle pulling at the tapes. For the covers, use the thinnest millboard. Cut two pieces of this to project about ¼ in. over the head, foot, and fore-edge of the book, and glue them in position on the projecting tapes, which will adhere to their inner sides. Over the tapes glue strips of coarse canvas B (Fig. 2), each strip being 1 in. wide by 6 in. long; then glue on the open back. When this glue is dry the volume may be covered with paper, cloth, leather, or vellum. Vellum must be lined first with clean white paper firmly pasted on it, and cloth covers must be fastened with glue; instead of glueing the tapes to the boards, cut a cloth cover large enough to allow for overlapping and for the width of the back, glue the covers on the cloth parallel with each other, and turn in the cloth round the edges. When this is dry, the book may be placed in the cloth cover, the tapes glued to the inner sides, the open back to the back of the cloth, and the strengthening canvas glued over the tapes; finally, the end papers being fastened down, the volume is finished. It will look a homely affair, but it will cost little beyond the trouble and will effectually preserve the volume. For many volumes published in numbers, the publishers supply covers; these may be securely fastened on by this simple method.

Electro-platers' Stopping-off Varnishes. — Best copal varnish is a good stopping-off varnish suitable for all-round purposes by electro-platers; after application, it should be allowed to dry for three hours, until it has got quite hard. This will stand the action of hot or cold cyanide solutions, and may be removed by the application of warm methylated spirit afterwards. An indication of its presence may be secured by tinting it with ultramarine or one of the aniline dye stuffs. Common varnishes may be employed in cold solutions, or a stopping-off varnish for use in cold solutions may be made as follows:—Place some crushed best red sealing-wax in a bottle containing naphtha, and stand the bottle in hot water until warm, then well shake the mixture until the sealing-wax has dissolved. Apply with a soft brush.

Design for Bracket to Verandah.—The accompanying illustrations show the end view (Fig. 1) and front views (Fig. 2) of a verandah supported on brackets; such a verandah is suitable for a small villa or cottage executed partly in half-timbered work and having a ground storey bay window projecting 1 ft. 9 in. from the main wall. The rafters, out of 3-in. by 2-in., are fixed at the top end to a ridge-piece nailed to the wall and at the bottom, birds-mouthed over plate A housed into the ends of the bracket heads, and rests upon and forms the head of the bay window. The housing may be simply a plain notch half the depth of the plate and nailed, or it may be rendered additionally secure by dovetail notchings, as shown in Fig. 3, where the head of the bracket is shown in full line and the plate and end rafter in dotted lines. The end rafters are kept flush with the outside of the bracket, and, if desired, the spandrel may be filled in with a ¾-in. perforated panel as shown. This panel should be placed lying and grooved ¼ in. into the rafter and head; the design of the perforation is based on the equilateral triangle, as shown by the dotted lines, and is easily described by bisecting the angles of the spandrel to find the centre lines of the arches. The brackets are mortised and tenoned together as shown by dotted lines, the tenons being painted and the foot of the rib screwed to the wall piece; the latter is fixed to plugs in the wall, 4½ in. being sufficient to insert the head into the wall, building in with cement. The gutter is worked in the solid out of 3¼-in. by 3-in. pitch-pine and screwed to the plate, the end being returned



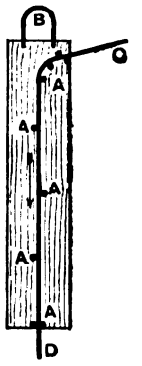
Design for Bracket to Verandah.

in the solid as shown in dotted lines (Fig. 2). The covering of plain tiles may be fixed to boarding or battens as shown; in the latter case a verge piece B is cut to fit under the tiles and cover the ends of the battens, finishing behind the gutter. A shaped apron lining (C, Fig. 2) is shown grooved into the under side of the plate and housed into the brackets, but, if desired, may be nailed direct on to the face of the plate, which would then be kept the thickness of the lining farther back. Figs. 4, 5, and 6 are respectively enlarged sections of bracket head, wall piece, and bracket rib. Figs. 1, 2, and 3 are reproduced to a scale of ½ in. to the foot, and Figs. 4, 5, and 6 are one-ninth full size.

Glazing in Coach Painting.—In any good job in coach painting it is the trade custom, when the body or carriage has been brought up to the first coat of the proper ground colour (which should dry in about eight to ten hours) to apply a second coat to make the first coat solid. In the third coat a good proportion of undercoating varnish should be mixed with the colour; this is called the glazing coat, and is put on to prevent the varnish on the body or carriage being absorbed by the undercoats of colour. The coat of glaze should stand for a day or two to get hard, and is then flatted for the next process of lining out, which requires for a good job a smooth, even surface. After the lining-out is done and dry, the work should be dusted off with a camel-hair brush kept for the purpose, and an undercoat of varnish put on; this should take two days to get thoroughly dry, and is flatted, as for the coat of glaze, with a pad of cloth well wet with water and fine pumice powder, washing off well so that no dust is left on the body or in the corners, for which a water tool should be used. The finishing coat of varnish is then put on in a clean, well-lighted shop, and in winter kept to a heat of 70° F. Sometimes blue and vermilion lines on carriages are glazed to produce a higher tint. As regards polishing a carriage, the work must stand at least six months before polishing is attempted.

Cleaning Watch Hairspring.—The correct method of cleaning a watch hairspring is to dip it in benzine and dab it dry on tissue paper several times in succession. Then remove any dirt that remains with a pointed watch peg.

Straightening Wire.—The illustration shows a block used for straightening wire, the method employed being understood easily. It is simple in construction, consisting of a block of wood 3 in. or 4 in. square and about 1 ft. 6 in. long. For the pegs A strong wire nails or pieces of wire may be used. To make the apparatus, first bend the wire C D to shape, lay it on the block, and knock in the nails or pegs as at A. The wire should be of the same thickness as that to be straightened. The loop of wire B is knocked into the block so that the latter may be fastened to the bench. Having made the block, the wire C D should be taken out and the wire to be pegged put in similarly to the wire C D. The wire is then pulled



Pegging Block for Straightening Wire.

out at D. Some little experience is necessary to make the wire come as straight as required. In pegging the wire, it may at first come out of the block curving to the left, or *vice versâ*. To remedy this, tap the pegs with a hammer to the left or right as required; thus if the wire curves to the left, tap some of the pegs to the right; if the wire curves to the right, tap the pegs to the left. Generally, the pegs will be found to control the straightening of the wire. The worker, whilst he is drawing it through the block, should get an assistant to hold the coil of wire. If it is wished to peg different sizes, several blocks should be made, say one for Nos. 11, 12, and 13 B.W.G., and one for Nos. 16, 17, and 18 B.W.G. In practice a separate block is kept for each two sizes, but where only a small quantity of wire is required, one block may be made to do for several sizes.

Fretwork.—In executing fretwork, first draw out the design full size, then inscribe the pattern selected, leaving a sufficient margin around the edges of the design to give strength where most of the weight hangs from. When the designing is finished, slightly shade the parts that are to be cut away, using Indian ink mixed with a little water. Next the whole should be inked in and then traced to save the design. The wood should then be planed to a smooth surface and the traced copy should be pasted on the board with thin paste. Before cutting out, to admit the fretsaw bore holes with a small gimlet in the centres of the parts that are to be cut away, leaving the outside edges until last, as the work is liable to snap in the centre. Then commence on the outside waste pieces and serve them the same way, working with very great care. After all the necessary parts are cut away, the fretwork should be held horizontally with the face downwards over a steam-kettle for a few seconds only; this releases the paper left on the fretwork surface, which should afterwards be rubbed very lightly with sandpaper. Then when the connecting parts are fixed together, the wood will be quite ready for varnishing.

Starches for Laundry Work.—Ordinary starch for linen usually is the same whether made with hot or cold water; but used cold it does not give such a stiff finish as the boiled. For sizing starches are made that break down even in cold water; these, of course, are different from ordinary starch. The usual starches sold for laundry purposes are maize (Indian corn) starch and rice starch, and for sizing purposes potato starch and sago starch. Starch is made from potatoes by rasping and washing them through fine sieves; the starch separates from the wash waters and, after several washings and settlings from pure water, is drained, dried slowly, and broken up. The other starches are similarly made, but hard materials like Indian corn or rice have first to be fermented or else treated with alkali in order to break them down.

Coat Suspender.—The bagging of a coat collar is generally due to hanging the coat by the ordinary neck loop, and the heavier the coat the more certain will there be the loss of form, which will become evident in time. It is usually wiser to employ a coat suspender, of which several varieties are in the market. A simple,

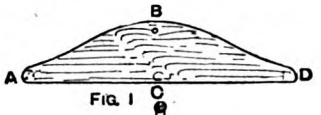


FIG. 1

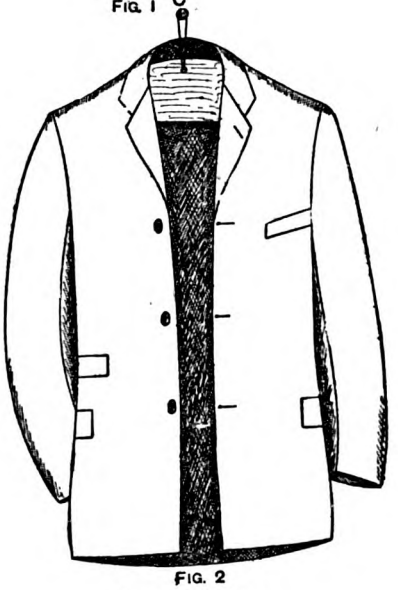


FIG. 2

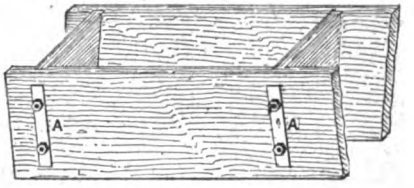
Coat Suspender.

effective, and inexpensive one may be made as shown in Fig. 1, using wood from ¼ in. to 1 in. thick. From A to D is about 18 in., C to B is 4 in., and the top edge on which the shoulders of the coat are to rest should be rounded to avoid "ridging." A hole is drilled about 1 in. below B as shown, and through this is passed a string for attachment. Fig. 2 illustrates the suspender in use; it greatly helps to retain the form introduced by the tailor.

Gilding Cardboard Mounts.—When picture mounts of cardboard or similar stuff have been cut out with a bevel edge the only practical method of gilding this edge is by covering it with gold paper. Paper for the purpose, called gilt binding paper, can be had from most stationers or mount cutters. Strips of this paper are carefully cut to size, pasted, put on the bevel, and turned in to the back. Special attention must be given to have the corners neat and to prevent the join from being unsightly. Such mounts are, however, often gilded before being cut out, but this process is beyond the amateur. A blocking press, three brass blocks, and a shaped steel cutter, will be required. One of the brass blocks is simply a frame, which may be of any shape; this is set up in the press, which is heated. The cards are prepared with the necessary size and gold leaf and blocked in the press, and when the surplus gold is wiped off a broad line is left on the board. The second brass block is simply a flat piece of brass smaller than the frame each way by the size of the bevel, say about ⅛ in. The third block is a larger frame than the first, and has a little larger opening. The three blocks comprise a set. When the gold line or frame has been blocked on the card, the block is removed and the second or solid block is set up. The large or third frame is arranged on the bed of the press. The card is next placed between these two blocks, and when pressure is applied in the usual manner a deep impression is made, which will bevel the gilded portion, and the card will have the appearance of a flat tray with a gold border. Then the steel cutter, of the exact size of the block which makes the depression, removes the centre. The various blocks and the cutter must suit the work to be done, and if the blocks do not register with each other, very imperfect work will be produced. For gilding the surfaces of picture mounts, follow the instructions given in Series I., p. 108.

Glossing Stiff Felt Hats.—A gloss for felt hats may be made by dissolving 1 oz. of shellac in ½ pt. of methylated spirit and for any desired colouring add aniline black soluble in spirit. This should be applied sparingly with a rag and the hat then ironed, but the hat itself should not be held over the stove. Another method is to place a piece of beeswax on a soft piece of flannel, and iron the wax into the flannel with a hot iron. While the flannel is warm rub it all over the hat, and then iron the hat; finally polish with a felt pad. These methods should be tried on an old hat first until experience with them is gained. Further information on reviving felt hats is given in Series I., p. 286.

Washing Trough for Laundry.—Pitchpine is the best timber to use in the construction of laundry washhouse joinery. For a trough 8 ft. 10 in. long, 1¼-in. stuff, finished size, should be used. The sides should be in two pieces, ploughed and tongued, the bottom being screwed on with brass or galvanised screws. Let the centre pieces and ends into the sides about ½ in., and fasten the whole



Washing Trough for Laundry.

together with galvanised plates A and bolts as shown in the illustration.

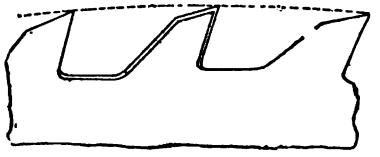
Plaiting Whip Lash.—For a four plait whip lash cut the thongs, leaving them together at one end for 6 in. for a keeper; cut that to a point, and cut the thongs narrower and pointed towards the other end; turn the keeper down so that it can be plaited over, and get a firm hold of it inside the lash. Then take hold of the most outward thong on the left-hand side, and draw it between the most outward thong on the right hand and the next to it; pass it over to the left, then take the extreme right-hand thong and draw it between the extreme left thong and the next to it and pass it over to the right, and so on till the plait is finished; keep the thongs flat, and roll the lash with good weight when finished and put over it some powdered chalk.

Cutting and Polishing Sections of Rock.—For a simple revolving cutter and polisher for sections of rock that could be attached to the table of a treadle sewing machine some special contrivances would be necessary. A second-hand headstock could be purchased and erected over the pulley wheel of the treadle, and a three-screw chuck obtained to suit the nozzle. In this chuck would be fastened the stick-brass to which would be attached the cutter; this consists of a steel disc about $\frac{5}{64}$ in. thick. Alongside the cutter should be improvised a rest, on which the rock is placed, and so pushed up against the disc as it revolves. In the process of cutting, diamond dust moistened either with turpentine or paraffin is applied both to the cutter and the rock. Diamond dust can be obtained from dealers in Hatton Garden, London, E.C. A cutter made as above is the best and quickest used. A cheaper method is to use a disc of copper and medium emery powder moistened with turpentine. In this case more than one disc would probably be needed. For polishing the rock, an emery wheel would take off the worst of the roughness, and then the polishing process would commence. The specimen is ground on a flat surface with varying grades of emery powder until the very finest is reached, and then the final polish is given either with rouge or putty powder, this last polish being given on a smooth steel surface plate.

Lithium.—Lithium is somewhat similar to alum in appearance. When freshly cut it looks like silver, but readily tarnishes in contact with air, becoming slightly yellow. It is soft and weldable and melts at 180° C. It is the lightest solid known—lighter than any known liquid. It is oxidised by water, so it is necessary to protect it from the air by keeping it in naphtha. It has no application such as has aluminium in manufacturing purposes.

White-lead Paint for Inside Work.—For a second-colouring coat for inside work, make white-lead paint thus. Procure 14 lb. of genuine white-lead and ½ lb. of patent driers and thin down with equal parts of linseed oil and turpentine. Second coats on old work should always be mixed with an abundance of turpentine, otherwise the paint will not adhere firmly. After the second-colouring coat has been applied, the work should be carefully stopped with a putty made from white-lead, gold-size, and turpentine mixed to a paste, and then rubbed down with No. 0 sandpaper until a perfectly smooth surface is obtained. Another coat should then be applied, using one-third oil to two-thirds turps. Rub down as before, and apply a coat of varnish colour made by mixing together white-lead ground stiff in turpentine and thinned down with French oil varnish. If a high-class finish is required, rub down with a felt block and flour pumice powder and apply a finishing coat of French oil varnish. When finishing with white varnished colour, lay the paint off as evenly as possible, taking care to obliterate all brush marks when finally laying off.

Form of Saw Teeth for Cutting Hard Woods.—A suitable form of tooth for hard woods is shown in the accompanying sketch. For cutting unseasoned



Form of Saw Teeth for Cutting Hard Woods.

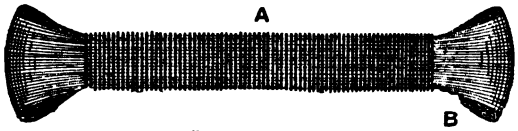
timber the lead of the teeth should be at an angle of about 70°. The transverse bevels should be at an angle of about 10°. For cutting dry or seasoned timber the angles should be less acute. From sixty to sixty-six will be a suitable number of teeth in the saw.

Slate Cardboard.—There are several ways of preparing enamelled writing surfaces on cardboard. The following is a method now much in use. A mixture of white or bleached shellac and borax is dissolved in 10 per cent. of water; concentrated glue size and mineral black rubbed to an impalpable powder is used for the first colouring material. In large mills the colouring material is transferred to the paper which is to be coated by means of specially constructed felt rollers and evenly distributed with brushes. The paper is then dried and rolled up. Another coat, which differs somewhat from the first and which consists of vine-black, glycerine, glue, and water, is then applied. In some cases, where a good quality is required, two or three coats are given, after which the paper is dried and cut up into suitable sizes and steamed at a temperature of 250° F. and finally smoothed by calendering (or drying through steam-heated rollers). The simplest method would be to mix equal quantities of flour emery and ivory black in white hard spirit varnish and apply with a wide camel-hair brush in a warm temperature. The addition of a small quantity of castor oil will give greater elasticity and prevent cracking.

Use of Galvanised Pipes.—The process of galvanising consists of cleansing the metal and dipping it in molten zinc. An idea prevailed at one time that the cleansing process was effected with acids that had a destructive action on the metal, but no such danger need be feared now. Therefore, the process is a strengthening one, as galvanising tends to make the metal a trifle thicker, and cleans the dirt out of the weak places and fills them with zinc. The generally recognised reason for galvanising iron goods is to prevent the iron rusting, and this preventive method will succeed if the water carried in the pipes does not attack zinc. In London, the waters are all hard, and the presence of lime prevents the water attacking iron and lead, so that the rule in London is to use plain iron pipes for hot-water work and lead pipes for cold water, and the iron pipes but very rarely give any trouble by rusting. In many places in the North of England the water is soft, and attacks iron and lead; in these cases nothing is gained by galvanising the iron pipes, as the water attacks zinc just as freely as lead and iron. In other words, when iron pipes are attacked by the water passing through them, galvanising the pipes seldom proves a remedy, as the majority of waters that exert a destructive influence on iron are destructive of zinc also. Notwithstanding this, the use of galvanised pipes and fittings is desirable, for with slightly hard waters (and under several other conditions) the protection afforded by the zinc (if lasting only for a little time) allows the pipe to get into a condition which prevents rusting. Malleable-iron fittings rust nearly as fast as wrought-iron, but are not so destructively affected, being, in this respect, like cast-iron.

Gilding Military Braid.—For electro-gilding military braid, a cage must be made of non-absorbent hard-wood, say lancewood. The braid must be lightly wound over this cage, with each fold side by side, but not crossing. The folds should then be interlaced with fine wire at two or more points of the cage, to conduct the current rapidly to all parts of the braid and thus prevent blotches in the gilding. A length of No. 24 S.W.G. copper wire should then connect all the other wires and form the slinging wire. First wet the whole in distilled water, then lower into the gilding solution (heated to 170° F.), and gild with a current of low voltage to prevent browning. When gilded, well wash in hot water, dry before the fire, and brush with a hair brush. Re-gilded braid rarely attains the lustre of new gold braid.

Scratch-brush.—A scratch-brush (see illustration, which is two-thirds full size) is made of fine steel wire bound with stout brass wire, as shown at A. When using the brush the end marked B must be cut across. The scratch-brush is of use in removing rust from gun-barrels, etc., but beginners are advised to start



Scratch-brush.

with a piece of scratch-card, as scratch-brushes are rather dear.

Casting Small Metal Teapots.—One method of casting metal teapots is described below. A brass mould, in two halves accurately fitting and smoothly finished inside, must first be made to the size of the teapot required. The moulds must be heated till only slightly cooler than the alloy being used, and well covered with a thin coating of lampblack and turpentine. Fix the two halves together and run in the molten metal. (After a little practice the time can be very accurately gauged.) After allowing the metal to remain till a thin crust has set, turn the mould upside down and run out the metal, which will still remain liquid, from the inside. The inside, while still in the mould, may be burnished to remove roughness if considered necessary. On separating the mould the teapot will be found to have a smooth and fine finish. The best alloy to use is one consisting of about 91 parts of tin to 9 parts of antimony. If the metal does not run as smooth as required (which will be readily seen after casting a few articles), add metallic bismuth, not exceeding 1 per cent. This increases the fluidity of the metal. The teapots can be finished under the polishing bob.

Coach Painters' Sandpaper Stopping.—Sandpaper stopping is made by mixing colouring matter, as lamp-black or drop black, and white-lead with turpentine 3 parts, gold-size 1 part.

Extracting Fat from Meat.—In extracting the fat from a quantity of rough meat and bones, the meat should be heated together with a small quantity of water in a digester that is fitted with a safety valve and a pressure regulator. The temperature can thus be raised to above ordinary boiling point by putting on 5 lb. or 10 lb. pressure, thus ensuring a better extraction of the fat. The liquid containing the fat in suspension should be run out into a shallow tank or bowl and allowed to cool; the fat will then pass to the surface and solidify, and may be readily removed. At the same time, all the soluble nutritive material of the meat will be dissolved out by the water, and unless utilised in some way would be wasted. It may be used either by drying it down on the meat fibrin left insoluble, or by incorporating it with other food. For instance, the meat fibrin may be mixed with barley or other meal, the liquid from the digester added, kneaded in, and baked into cakes, which may be ground to powder in a disintegrator, forming a very nutritious meat meal. If it is only desired to dry the insoluble fibrin, this may be done on trays in an oven.

Measuring Lead on Dome.—The simplest plan of measuring up the lead on a dome is to measure up the superficial area of the dome, and add to that sum sufficient to account for all rolls and passings, etc. To find the area of the dome, assuming that it is a true hemisphere, the rule is: diameter of base × 3·1416 × vertical height. Example: A dome 20 ft. in diameter, and covered with 7-lb. sheet lead; 20 × 3·1416 × 10 = 628·32 super. ft. This dimension × 7 = 4398·24 lb. = weight of lead on the dome. On such a dome would be about twenty-six rolls, running from the eaves to the apex; and each roll would require a strip of lead 8 in. in width. The length of the rolls would be (20 × 3·1416) ÷ 4 = 15·7, or say, 15 ft. 9 in. Then 15 ft. 9 in. × 8 in. × 26 × 7 lb. = 1911 lb. Added together = 4398·24 + 1911 = 6309·24 lb., or 2 tons 16 cwt. 27¼ lb. = the total weight on the dome. Any horizontal laps or passings, owing to the bays being put on in two or more pieces, would have to be allowed for, and the extra weight added to the above total. A further allowance would have to be made if it were intended to fix an apron round the base, or any ornament or finial on the apex.

Charging Syphon.—Fig. 1 shows a simple method of charging a syphon, when the perpendicular height of the shorter leg does not exceed 25 ft. or 26 ft. The well B is supposed to have about 3 ft. of water. C, the point where the water is wanted, may be any distance from the well, but must be below the level of the water. A pipe, with a screw-cap H, is soldered to the highest part of the bend, and made perfectly air-tight with a leather washer. For a large syphon a flange and cover should be used instead of a screw-cap. The syphon is charged by removing the screw-cap and pouring water in until the syphon is full. This must be done gradually to

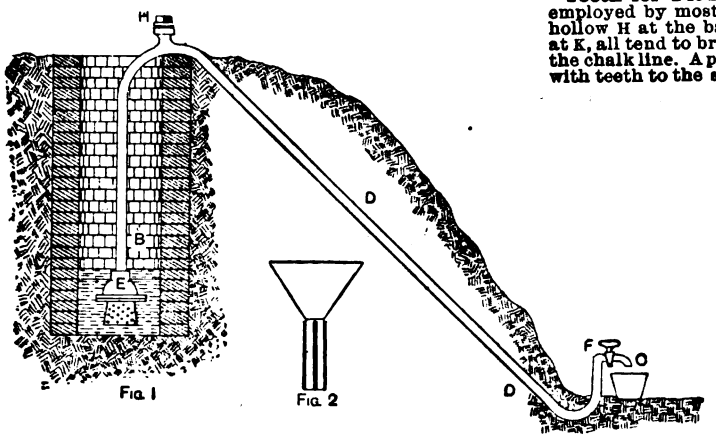


Fig. 1 Fig. 2

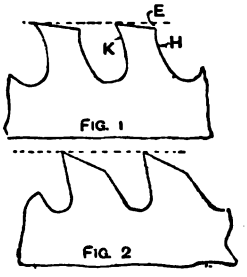
Charging Syphon.

allow the air to escape as the water descends. The funnel shown in Fig. 2 will be found useful in filling. On the outside of the pipe are soldered lengths J of ¼-in. brass wire to fit inside the syphon pipe, and the space thus formed will allow the air to escape. When the syphon is quite filled, the top of the pipe must be made perfectly air-tight; then, on turning the cock F, the water will commence to flow through D, continuing to do so as long as any water remains above the foot valve E, which has a strainer. The pipe forming the syphon should be perfectly air-tight, as otherwise the working of the syphon will be interfered with.

Moulded Ornaments for Picture Frames.—Mould ornaments for picture frames may be made from a composition of whiting, water, glue, linseed oil, and resin. The proportions of the different ingredients may vary, but the mixture should be soft and pliable, and should harden in a day or two if the ornament is large and heavy, or in a few hours if small and thin. The following proportions may serve as a guide, 1½ pt. of water, 5 lb. of glue, 1 pt. of linseed oil, and 2 lb. of resin. Boil the whole together, and add sufficient whiting to render it of the required consistency. If more is made than is required immediately, it will require steaming to make it workable, as it soon begins to harden. The composition is pressed into moulds, which may be of wood, metal, or sulphur. The wooden moulds are carved or hollowed out of boxwood. For the other types of moulds, a model representing the object or ornament to be cast is made in clay or composition. This model is then surrounded with a wall of clay (or composition), given a coat of sweet oil, and the molten metal poured over it. When cold, the model is removed from the mould and set in a wooden case. A piece of composition in a warm and soft state is then taken and pressed by hand into the mould. A wet board is placed over the surface of the mould, and screwed or weighted down; and this pressure, besides helping to force the composition into the mould, also makes it adhere to the wetted board, so that it may be readily pulled from the mould. When the cast is newly made, it is pliant and flexible, and may be fixed to curved or flat surfaces. When in this condition, hot water is sufficient to make it adhere, but if allowed to harden, it may be fixed to a frame with glue.

Arranging Spokes in Cycle Wheels.—The arranging of spokes in a cycle wheel is so that the valve-hole in the rim will be between two spokes running nearly parallel, thus giving more room for the hand when adjusting the valve or inflating the tyre. When the complete wheel is viewed from the side, the spokes should appear to be arranged in bunches of four, as it were. The outside spoke of these bunches will be seen to run nearly parallel with the outside spoke of the next bunch, thus leaving more space between these two spokes, and one of these spaces is the proper position for the valve-hole. There has been observed in good shops a system of wheel building which seems very convenient. A few spokes are first inserted in both flanges of the hub; these pull almost opposite each other and tighten in the rim, the hub thus being made central and rigid. The wheel is then placed in the trueing stand and the remaining spokes are fitted. This way is preferable to first spoking one side of the wheel, as it is easier to handle the wheel while building it, besides being much speedier.

Teeth for Pit-saw.—The form of tooth in the saws employed by most pit-sawyers is shown in Fig. 1. The hollow H at the back, the high heel at E, and the hook at K, all tend to bring the dust on the top and so obscure the chalk line. A pit-saw properly worked and sharpened, with teeth to the shape of Fig. 2. should bring but very



Teeth for Pit-saw.

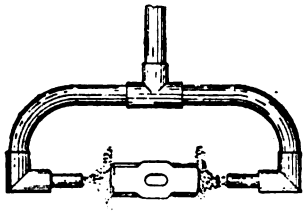
little dust to the top of the cut after the saw has cut into the timber to the extent of the width of the saw.

Painting Window Frames to Resemble Stone.—For the imitation of wrought freestone, one method is to prime the window frame with two coats of genuine white-lead tinted with yellow ochre mixed with 3 parts of boiled oil and 1 part of turpentine, allowing each coat to dry thoroughly; apply over the lead paint two coats of stone-colour Duresco water paint; this should be dabbled on with a pound brush, and not laid off in the ordinary way. With a little experimenting the desired result may be easily obtained; but, if necessary, coarse sand or other material may be added. By adopting this method, the paint will be found to dry hard with a dull surface resembling stone, and also it will withstand atmospheric influences.

Take-up Spring in Pfaff Sewing Machine.—The take-up spring in a Pfaff sewing machine regulates the amount of slack thread which the needle will throw out for the shuttle point to catch. This is also the use of the slack-thread pin. The reason why some machines are provided with the one, and some the other, is the difference in design, but, roughly speaking, where the take-up lever has a positive movement—that is to say, one which is driven by a link or cam, and which therefore cannot be varied—there is provided a spring to compensate for differences of cotton and material. As to the needle grooves, every needle is designed to give the best results in the machine it is intended for, and some have two long grooves, some one. The short groove ensures a loop being thrown out at the back. The amount of slack thread should be adjusted so as to ensure the cotton being kept tight until the eye of the needle enters the work.

Staining and Polishing Chest of Drawers.—A chest of drawers constructed in red pine, if at all rough and with resin exuding around the knots, should be treated in the following way. With a sharp corner of a chisel scoop out a groove round the knots to remove the resin, and if the knots are loose, knock them partly out, touch round with glue, and knock them back again. For the rough places and round the knots mix best whiting into a stiff paste with very thin glue or patent size, adding a small quantity of dry brown umber to give it a walnut colour. Then with a putty or table knife spread it well over all rough and hollow places and set it aside to harden; then smooth down with No. 1 glasspaper held over a flat pad of cork or a smooth piece of wood. If the wood is to be stained walnut, mix equal parts of dry brown umber and vandyke brown in liquid ammonia to a thin paste-like paint, and add rain-water till the colour required is obtained, testing on odd pieces of similar wood. Apply with a brush, rubbing well in and finishing off in the direction of the grain with a piece of coarse rag. When dry, smooth down with No. 0 glasspaper, wipe over with raw linseed oil, apply polish to seal up the pores, and with a camel-hair brush add one or more coats of spirit varnish. When this is dry, rub down with worn glasspaper and apply more polish till a level, bright surface has been gained. Paste filler need not be used if this method is adopted.

Hardening Cast-steel Hammers.—For hardening small hammers the instructions given on p. 41 may be followed, but for heavy hammers the point to be observed is to keep the centre of the hammer face as hard as the edges. The illustration shows the method of hardening a farrier's two-faced hammer. Water from the



Hardening Cast-steel Hammers.

main or cistern is led to the faces as illustrated. If a heavy hammer red hot is kept still in cold water for some seconds and taken out it will be found to be black at the edges of the face, but the centre of the face will be almost as red as when plunged into the water. It is therefore obvious that some method like that illustrated is necessary to cool the faces equally.

Burgundy Pitch Distemper.—Burgundy pitch, which is known also as pine resin and white pitch, is an impure resin obtained from the spruce fir-trees that grow in Norway and Sweden. Very little of the genuine pitch is placed on the market, an artificial pitch, prepared from melted resin 12 parts and linseed oil 1 part, being chiefly used. It is principally employed in the preparation of plasters. Burgundy pitch may be used in washable distempers, but there are other materials that give better and cheaper results. Casein, gum arabic, glue, and glucose are the principal binding agents now used. A distemper containing Burgundy pitch may be made as follows. Procure 5 lb. of Paris white, 7 lb. of slaked lime, 7 lb. of zinc white, 2 lb. of powdered glue size, ½ lb. of Burgundy pitch, ½ lb. of borax, and 1 gal. of water. Dissolve the glue size, pitch, and borax in boiling water, then add the lime, finally stirring in the Paris white and zinc white, care being taken to avoid lumps. The above recipe makes a good white. Other colours may be prepared by omitting the Paris white and zinc white, and replacing them with a good quality dry colour. A little raw linseed oil added before using binds the preparation and renders it more washable.

Toning Photographs on Albumenised Paper.—The most suitable toning bath for commercial (not home-prepared) albumenised paper is (A) Borax 80 grs. dissolved in 10 oz. of hot water; (B) 2 grs. of gold dissolved in 10 oz. of water; mix A and B. The bath must not be used before it has cooled down to about 60° F. After thorough washing of the prints to rid them of any free silver nitrate, immerse the prints in the toning bath. The prints must be kept moving until the desired tone is reached; toning will take about fifteen minutes. As the desired tone is obtained on the prints, transfer them to a dish of water, and finally fix in hypo 3 oz. and water 1 pint. The above quantity of toning bath suffices for one whole sheet of paper or about fourteen half-plates. For a smaller number of prints a smaller quantity of toning solution should be made up, as the bath will not keep. The prints, before toning, should be immersed for a few minutes in a bath of sodium chloride (common salt) and then rinsed. The sodium chloride bath ensures the thorough removal of any silver nitrate that may be left on the prints. A teaspoonful of salt to a quart of water will suffice.

Printing Photographs in Sunlight.—Photographs should never be printed in the sunlight, except, perhaps, ferro-prussiate blue prints. The effect of printing in sunlight, and to a proportionably less degree in strong light, is to flatten the contrast and produce a red-brown image which does not tone to such a pleasing colour, whilst in the case of vignettes their outlines would be rendered hard and decided.

Cycle Tube Bending Jig.—A bend to a radius of 1 in. inside on a ¼-in. diameter tube is, of course, a very short bend, and it would be better to use a thicker gauge tube than is required, for any slight buckles could then be polished out. Make a bending jig as shown in elevation and plan by Figs. 1 and 2. Plug one end of the tube and fill it with lead, melt the lead, and warm the tube so that it is filled up closely. One end of the tube is fastened down to the plate, and the tube bent by means of the lever round the mandrel, which is slightly smaller than the inside diameter of the tube when bent. The mandrel and the wheel on the lever are grooved to take the tube to be bent. The mandrel could be fixed on a pin as shown and larger bends made by substituting a larger mandrel. The lever would then

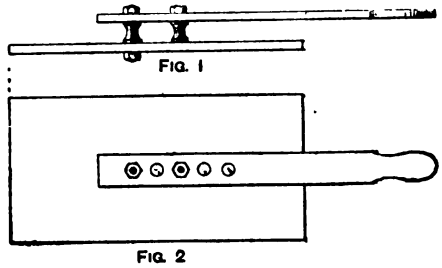


FIG. 1

FIG. 2

Cycle Tube Bending Jig.

have holes at suitable distances for the increased radii. It would probably be better for sharp bends to make complete circles as far as possible and cut the tube up to the required lengths. The tube is heated and the lead run out before cutting with a hacksaw.

Fixing Air Valve in Water Main.—All that is necessary in fixing an air valve in a water main is to drill and tap a hole in the highest part of the main where the air is likely to accumulate, the size of the hole suiting that of the valve to be fixed. For a 3-in. main a ¾-in. valve would be large enough, and this would require a hole screwed for a ¼-in. pipe. A stopcock should be fixed between the valve and the main, so that any necessary examination or repairs could be made without emptying the main. A cover box should be fixed over the valve to protect it from injury or from tampering, and the valve should also be protected from frost.

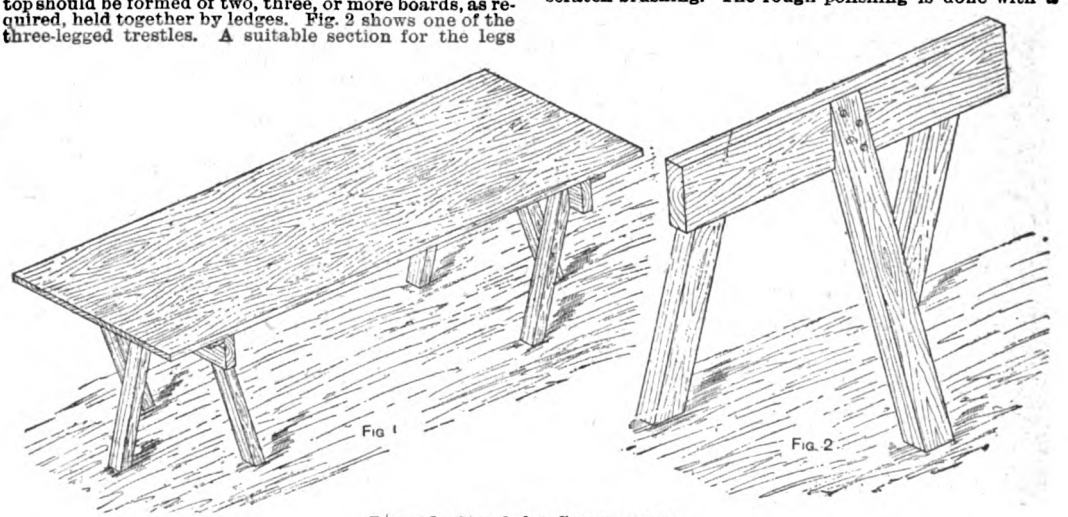
Exposure in Enlarging Photographs.—The rule for finding the proportionate exposure in enlarging photographs is to add one to the ratio and square it. In most cases the best plan is to make a trial exposure, a plate being exposed in three sections. Having formed an idea of what the correct exposure should be, expose the centre portion of the plate for this time, and the other portions one for half and the other for double that time. To do this, draw out the shutter one-third of its length and give the supposed correct exposure; now draw out another third of the shutter and give half the first exposure; then draw out the rest of the shutter and give once again the second exposure. The portion of the plate that is the most nearly correct is taken as a guide, a further test exposure being made if necessary. Once found, the exposure and all necessary conditions of light, stop, plate, subject, and diameters are entered in the notebook.

Worm-holes in Violin.—The best way to kill the worms in the wood of a violin without damaging the instrument is to inject into the holes a solution of corrosive sublimate (bichloride of mercury) in spirit or in boiling water. Then fill them up with fine sawdust and thin glue. Be careful with the sublimate, as it is a very deadly poison. Perchloride of hydrogen is also recommended, and certainly is safer to handle than is the corrosive sublimate.

Casts of Carved Picture Frame.—For making a mould from which casts of a carved picture-frame corner can be taken, give the carving a thin coating of preparation made by dissolving a small quantity of stearin or wax candle in paraffin oil. Plaster-of-Paris may then be poured over the carving without fear of sticking; or, instead of plaster, equal parts of beeswax and resin may be used. For picture frames a composition of linseed oil, whiting, glue, and water may be made into a paste and pressed over the carving, which must be given a coat of sweet oil. Pull the pressing off while still soft and set aside till quite hard. This will serve as a mould from which any number of casts may be taken.

Removing Paraffin from Carpet.—To remove paraffin from a carpet place a quantity of blotting paper on the soaked part and run a warm iron over it; continue this treatment until the paraffin is removed. For removing a stain left by the evaporation of paraffin wet well with petroleum spirit and treat with the blotting paper as above.

Portable Stand for Greengrocer.—Fig. 1 gives a general view of a portable stand for the outside of a greengrocer's shop on which to place baskets, etc. The top should be formed of two, three, or more boards, as required, held together by ledges. Fig. 2 shows one of the three-legged trestles. A suitable section for the legs



Portable Stand for Greengrocer.

would be 3 in. by 2½ in., the horizontal piece being 5 in. by 2 in. The legs should be cut to fit as shown, and the most satisfactory way of securing them to the top is by stout screws.

Repainting Bassinette.—The ironwork, springs, wheels, etc., of a bassinette are usually painted with enamel, which may be procured from most ironmongers. The body and general woodwork are painted and then varnished. The paints used are specially ground to a stiff paste in turpentine, afterwards thinned down with 4 parts of turpentine and 1 part of gold-size. The paints are applied in the usual manner, allowed to dry, and rubbed down lightly with No. 0 sandpaper, dusted, and then given a coat of hard copal varnish.

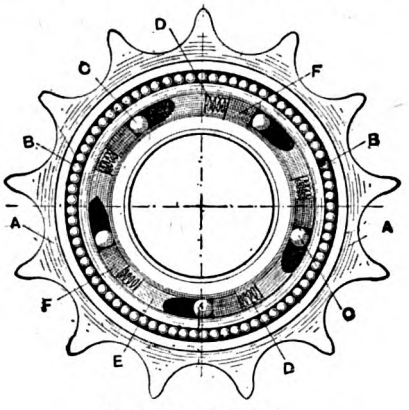
Analysing Mixture of Waxes.—In the analysis of a mixture of beeswax and paraffin wax it is not usual, nor is it necessary, to separate them. Beeswax consists principally of cerotic acid and myricyl palmitate; the former will combine with alkali readily, while the latter can be saponified if heated with an alkali. Paraffin is a hydrocarbon, and will not combine with an alkali under any condition. The analysis of a wax by Hubl's process is as follows:—2½ grams of the wax are carefully weighed out, dissolved in hot alcohol (neutral), to which a few drops of phenol-phthalein have been added, and ½ normal caustic potash solution is dropped in until the liquid is faintly pink; this represents the amount of alkali required to neutralise the free cerotic acid. 25 c.c. of the ½ normal alkali are now added, and the flask is heated for forty minutes under an inverted condenser, after which the excess of alkali is determined by titration with ½ normal hydrochloric acid; the amount used is that required to saponify the myricyl palmitate. The determinations are calculated into the number of milligrams of caustic potash required for 1 gram of wax, and the cerotic acid determination, called the "acid value," the myricyl palmitate determination being called the "ester value"; the sum of the two represent the "saponification value." The acid value of beeswax is 20, the ester value 75, and the saponification value 95. As paraffin wax has no acid or ester value, a mixture of it with beeswax will lower both values in proportion to the amount of the former present, and the composition of the mixture is easily calculated. There is a rough way of determining the paraffin by heating the wax to 150° C. with strong sulphuric acid; this destroys the beeswax while not affecting the paraffin wax, which can be separated and purified; but as beeswax contains 13 per cent. of hydrocarbons, this process is not used.

Finishing Silver Fretwork Articles.—When finishing silver articles, if the fret cutting is completed, with a dead smooth file take off the burr or "fash" left by the fret saw. Next rough polish by means of a buffing lathe, which consists of a central headstock with right- and left-hand mandrils, and fitted with fast and loose pulleys in the centre. The mandrils extend from 12 in. to 18 in., according to the nature of the work to be done, and each mandril has a taper screw at the end on which to secure the polishing buffs. These may be of leather, linen, or a hard or soft brush, which again may be of bristle, soft brass, or even of hard steel as for scratch-brushing. The rough polishing is done with a circular buff, say 3 in. in diameter for small work. The leather, called "bull neck," is cut as round as possible, a small hole punched in the centre and screwed on the taper screw of the mandril, and the disc is turned up true with an old sharp knife, an upright piece of wood being used as a hand-rest. This is fed with prepared Trent sand and common oil, the article being held underneath the revolving buff and worked backwards and forwards till the scratches are removed. If the silver is very thin it is usually placed on a small flat piece of wood to prevent its being bent. At this stage the work is sent to be engraved or otherwise ornamented. The work should then be boiled in a strong solution of potash, 1 lb. of potash to 2 gal. of water, to remove grease and dirt. The leather buff and Trent sand is then put aside in a cloth to be used over and over again. A linen dolly about 6 in. in diameter is screwed on the mandril nose, and rouge and water made into a thin paste is applied with the finger to the piece to be polished, which is then put in contact with the revolving dolly. This is repeated till a high condition of polish is attained. The final polish by power is arrived at with a lead lap fed with still finer rouge paste, and otherwise by "handing up." This consists in the work being polished by friction, using the ball of the thumb with fine rouge paste. Next the article is washed out in hot water, dried in hot boxwood sawdust, and polished with a clean chamois leather and then carded. Another system is lightly to electroplate the silver goods, and then hand-burnish the various parts in order to produce an effect of light and shade in the general appearance.

Cementing Bass Brooms.—Brushmakers' pitch is the best material to use for securing bass in brooms. This material is kept melted over a slow fire, and applied like glue to the holes in the broom heads, the bundles of bass or bristles being forced in while the pitch is still hot.

Pipe Tongs.—When forging pipe tongs, make the jaw that *grips* the pipe, and work from that when making the jaw that *clips* the pipe. For small tongs, say from ⅜ in. to ½ in., it is a good plan to forge the grip jaw out of solid steel, as the part that grips the pipe is so small that there is some difficulty in facing them with steel. When using iron, roughly forge the jaw nearly to size and then get a piece of double shear steel of the width of the part that grips the pipe and about ¼ in. thick; take a welding heat on the steel and the top part of the jaw, put the steel along the edge of the anvil nearest the worker, place the iron on it, and smartly weld together with the hand hammer. Cut off the steel that hangs over the edges of the iron, square it up, take a second welding heat on it, and clean up and finish to the desired size. Then forge the other jaw and fit the two to the size required.

Fitting Free Wheel to Safety Bicycle.—With one or two exceptions, free wheels can be fitted to the hub in place of the fixed wheel without any alterations. In these exceptions the clutch is part of the hub, and must be used to build the back wheel. The free wheel is made mainly on two principles, the roller friction, and the pawl or ratchet. To fit a free wheel, the old chain ring must be removed, and the diameter of the hub barrel and the number of threads to the inch ascertained, so that the free wheel may be bought with the same thread, etc. To remove the old chain ring, the lock ring which has a left-hand thread, and

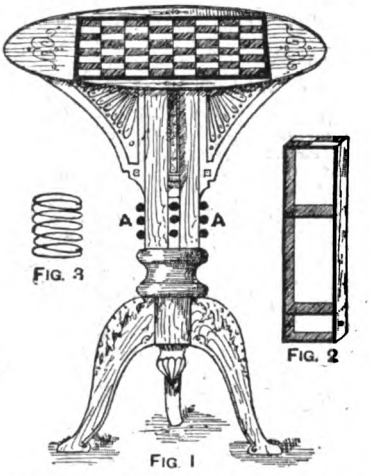


Free Wheel Clutch.

unscrews to the right, must be taken off. Pin-holes are provided in the top of the lock nut; a pin spanner should be made to fit these holes, or the nut may be knocked round with a small punch. The chain ring can be removed with a punch or a chain-ring wrench. All that it is necessary to do is to remove the chain, take out the back wheel, remove the lock nut and chain wheel, screw the free wheel on the hub as far as possible, replace the wheel and chain, and turn the crank round until the free wheel is locked tight against the shoulder of the hub barrel. The accompanying sketch illustrates a roller friction clutch with the front plate removed. A is the chain ring; B, ¼-in. balls; C, rollers; D, springs; E, clutch. It will be seen that the clutch is screwed on the hub barrel, and always revolves with it. When the chain ring is pulled round in one direction, the five rollers are drawn by friction against the ring up the five inclined planes, and are jammed between the clutch and ring, and the road wheel revolves with it. When the chain ring is held still, as is the case in free-wheeling, the clutch revolves with the road wheel, causing the rollers to run back into the bottom of the inclined planes, where they are kept by friction against the hub ring until pedalling commences again. The blocks F at the back of the rollers are to keep them square, and the small spiral springs keep the blocks up to their work. The ¼-in. balls take up any side-play. In the ratchet clutch, the chain ring has a ratchet running round its circumference. In recesses in the clutch pawls are fitted, which engage with the ratchet while driving. When free-wheeling, the pawls run over the ratchet, as in an engineer's ratchet brace. In some cases rocking pawls are used, but in most cases the pawls are kept up to their work by a flat or small coil spring. It is necessary to lubricate a free wheel frequently, and occasionally swilling out with benzoline or paraffin will prevent the springs and rollers sticking with dirt, which is generally the cause of clutches slipping. Free wheels combined with back-pedalling brakes are on the same principle, with the addition of a brake drum and block. The brake is generally applied by a rising cam, which forces the brake block into the drum.

Cleaning Oily Floor.—To clean a wood floor that is saturated with oil, wash and scrub the floor with benzoline; mix 1 lb. of quicklime and 1 lb. of soda in a bucketful of hot water, and with this well scour the floor. A little Calais sand may also be used with advantage. By adopting this method the oil can be easily removed, providing it is on the surface and has not penetrated through the wood.

Chess Table with Secret Spring Drawer.—Fig. 1 illustrates a chess or draughts table with secret spring drawer, which can easily be made; only the construction of the trunk requires a few words of explanation. This trunk has a deep hole into which the secret square drawer, of about 3-in. side, is dropped; the four middle squares of the chess board form the top exactly (see Fig. 2), and must fit into place accurately to hide the presence of the drawer. It will be noticed that the drawer should be shorter than the portion of the body into which it fits by 2 in. This is for the spring, which consists of a few turns of an ordinary upholsterer's chair spring, standing 3 in. high (as in Fig. 3), and which can be dropped into its place without any fastening. The two middle knobs A (Fig. 1) on each side of the trunk have pins on them which go through the



Chess Table with Secret Spring Drawer.

body into the holes (see Fig. 2) at the bottom of the secret drawer and so hold it in its place. The two middle knobs have only to be pulled out to make the drawer rise 1 in. above the table top, when it can be lifted out, and as the twelve knobs must be exactly alike, it will not be an easy matter for the uninitiated to guess the secret fastening.

Welding Cast Steel Picks.—Some so-called cast steel picks are made of unweldable metal. The only thing to be done with this kind of tool is to keep drawing it down until worn out and then consign it to the scrap heap. However, if the picks are made of a steel that will weld, the best way to line them up is to thicken the end well by jumping up, then split it open with a hot chisel and form a V scarf. Forge the end of the piece of iron to correspond. For the welding heat, get the iron to a white heat and the steel to a yellow slimy heat. For a flux, use clean white sand for the iron, and for the steel use a composition made up from 2 oz. each of common chalk, common soda, and burnt borax, and 1 lb. of silver sand well mixed together. Well roll the steel in this mixture several times whilst getting the welding heat.

Painting Aquarium.—A suitable paint for the inside of a fish aquarium may be made by mixing together 3 parts of good copal varnish and 1 part of gold-size; use this varnish as a medium for mixing with zinc white. Any good paste paint may be used for tinting the white. Aspinall's bath enamel is also suitable for the purpose.

Setting Chronometer in Beat.—A chronometer is in beat if the impulse pallet in the large roller points exactly to the 'scape-wheel pivots when the balance is at rest. It is set in beat by turning the hairspring collet round as required.

Wooden Wall Brackets.—Figs. 1 and 2 illustrate two easily made brackets, for which common white wood ¼ in. thick, finished to about ⅛ in., may be used. The brackets may be stained green and given one or two coats of shellac, but a thick varnish should not be used, as the appearance is better with little or no polish. The bracket illustrated by Fig. 1 is 9½ in. by 12 in. in the main opening, and 5 in. deep; the other proportions can be obtained from the sketch. Commence by cutting out the two curved pieces which form the back. This can be done with bow saw, gouge, and spokeshave, or with the fret saw. Then cut out the two sides. The larger holes should be removed by the fret or bow saw and finished off. Erect these sides in position on the back pieces about 1 in. from the straight edge and nail them on. Cut out the four small side brackets, rounding them in front. Put a little glue on the edges and then nail them in position, both to the side and back; the two wings which unite the back and sides will then be complete, and the three shelves will join them together. Cut out four pieces of wood, each 3½ in. long and ¼ in. square; glue these in the corners, behind the little curved pieces with the round holes in them, in such a manner that the shelves are fixed in place. Next cut out pieces to form the top and bottom part of the back. The lower piece has a heart cut through it, and the upper one a curved top. Make these fit exactly between the sides, projecting 1 in. into the opening, and nail them to the back

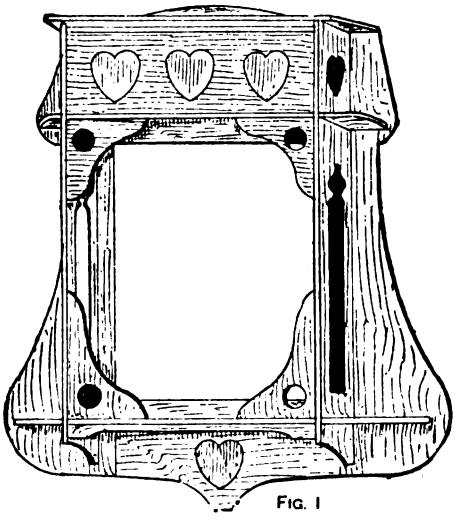


FIG. 1

edge of the shelf Now cut out the front top with three hearts, and glue it in place. Along its upper edge glue a strip of wood 1½ in. wide, projecting forwards ⅛ in., and having the ends bevelled to match two tapering pieces fastened on the top edges of the sides. Flower pots with ferns in them may stand in the well behind the hearts, and it only remains to glue the four corner pieces in place. The back looks well if filled in with pleated china silk. The horizontal bracket (Fig. 2) measures 24 in. between the sides, the height between the shelves being 8 in., and the depth 4 in. From two pieces 6 in. wide and about 14½ in. long the two curved portions of the back are cut. On these the ends are nailed in position. The bottom shelf, the ends of which are curved, is nailed to the sides and back pieces, and then the upper shelf is fitted and nailed to the sides. Finally the partition for the cupboard is fitted and nailed. The decorated curved piece is fixed ¼ in. from the front edge, and the central lower part of the back fits between the side wings and is nailed to the back edge of the bottom shelf; it projects 1 in. upwards, a plain clip, 2½ in. wide, projecting 1 in. downwards, being nailed to the back of the upper shelf. The curved pieces for the opening are glued in, and the door is cut from a single piece, and has two light battens screwed across it inside to prevent warping; it is fastened at the bottom with two light hinges, and two long sham hinges are cut out of thin copper, well polished, and pinned to it when the whole has been stained and varnished. To make the two boar's heads, cut a piece of 1-in. soft wood 5 in. long by 3 in. wide, and plane the top smooth. Flatten a piece of soft copper rather more than $\frac{1}{16}$ in. thick and 6 in. long by 4 in. wide by putting a piece of smooth wood on it and striking with a hammer. Cut off a triangular piece from each corner and place the copper on the prepared wood and turn down the edges, driving some tintacks through the copper into the wood. Draw the outline of the head with a soft pencil or ink, making it a little bigger all round than the finished size. Then run a fairly broad blunt bradawl round the lines, tapping it continuously with a hammer or mallet, and thus indenting a continuous line in the copper. Now cut the point off a long French nail, making it quite square so as to form a blunt punch. With this go all round the outline, just touching the latter, and hitting a fairly hard blow with the hammer. The copper under the punch is thus driven down into the wood, the remainder all round rising. Then with the bradawl once more trace the outline, but hit hard enough to cut through the copper. Finish the rough edges with a smooth file and polish the front with fine emery or sandpaper. The eye may be drilled or punched, and four holes for pins should also be made. Two small brackets, not illustrated, are glued so as to hide the heads of the nails fastening the upper shelf, and two top shelves with bevelled edges are secured to the sides. The back may be left open, or filled with glass or silk. The sham hinges are cut out of thin copper with a strong pair of scissors, and a little repoussé work put into them improves the effect.

Repainting Butcher's Cart.—To repaint a butcher's cart dark green, with light green picking-out lines, give new work three coats of light colour made from tub white-lead and a little driers, thinning down with raw linseed oil and turpentine, and adding a little vegetable black or lampblack to give tone. When this is dry, a coat of dark lead colour is given, after which two coats of dark green paint are put on, the first coat being made to dry in about ten hours, while the second coat should have a little carriage varnish added to it to make a good job.

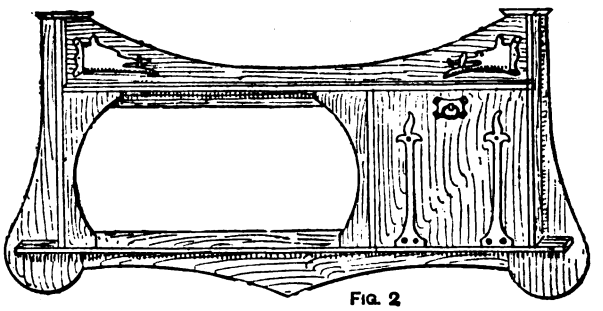


FIG. 2

Wooden Wall Brackets.

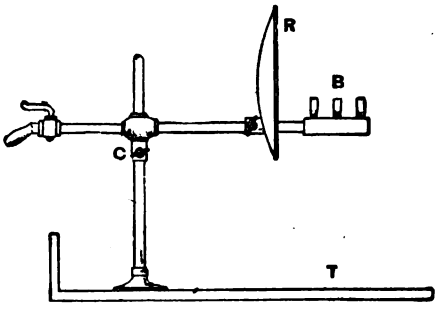
A third coat, with varnish added, would give a good surface, and should stand for two days to harden. It is then flatted down with pumice powder and cloth, using plenty of water. Then the lining out is done, after which the body and other parts are sponged to remove any pumice dust that may have been left on, using a No. 6 water tool to get all dust out of the corners. When the wood has been dried off with a chamois leather, apply a coat of hard-drying carriage varnish, which should stand for one day to harden off, and is then flatted down as for the last coat of green, a coat of finishing carriage varnish being added. If the weather is damp or muddy, the cart should not be used for two weeks, or mud will make white spots in the varnish; in bright weather it may be used in a week from when it was finished.

Painting Wood Flesh Colour.—In painting new wood flesh colour good results may be obtained by first applying a paint composed of 7 lb. of white-lead, ½ lb. of patent driers, ½ pt. of boiled oil, ½ pt. of turpentine, and ¼ lb. of venetian red. Mix well together to a uniform consistency, strain, and brush well into the wood until all suction is stopped, finishing by laying off lightly. Allow the paint to dry hard, rub over lightly with No. 0 sandpaper until the surface of the wood is perfectly smooth, then apply a coat of paint made by mixing together 6 lb. of zinc white, 2 oz. of yellow ochre, and 1 oz. of venetian red, all paste paints ground in oil. Thin down to the required consistency with ½ pt. of boiled oil, ½ pt. of copal varnish, ½ lb. of patent driers, and ½ pt. of turpentine; apply thinly and evenly. This preparation dries hard with a good gloss in a few hours. For a very brilliant finish, omit the copal varnish and replace with boiled oil. Allow it to dry hard, and apply a finishing coat of hard copal varnish.

Removing Leather from Brass.—Boiling in a strong solution of caustic soda will destroy the leather so that it can easily be stripped from the brass without appreciably affecting the latter.

Light Yellow Stopping for Stone.—For stopping some of the Derby grits, such as Darley Dale, etc., shellac stopping as used for the oolitic stones is of no use. The following, however, is useful. Mix resin and beeswax in about equal parts over a fire, or preferably over a hot plate, in a pipkin, until the resin and beeswax are melted and well incorporated; add sufficient dust of the pounded stone to produce a stiff paste, which, when thoroughly kneaded, should be poured into water and made up into sticks, and the cement is then ready for use. To unite broken pieces of stone or to fill up a cavity, warm the affected portions of stone by means of hot irons until the stones are just hot enough to melt the cement; apply the cement to the fracture and smooth off with the iron. This cement has no lasting properties when exposed to the weather, but will serve for internal work. If the piece of broken stone is not too large, use Portland cement mixed with some of the pounded stone-dust, and a little mineral oxide to produce the necessary colour. This will make a far more satisfactory and lasting job than the resin-beeswax cement described above.

Acetylene Burner for Optical Lantern.—The accompanying illustration shows an optical lantern fitting for burning acetylene. The only part needing description is the arrangement of burners. Those generally used are Bray's No. 000 (acetylene), and the light given is about equal to 200 candle power. The burners may be placed in a row as shown, or may be arranged so that all three burners will face the lens, one above two like a triangle. The illumination obtained



Acetylene Burner for Optical Lantern.

by this means is not sufficient for cinematograph films if large pictures are to be shown, but would be suitable for small pictures, say 10 ft. in diameter, perhaps a little larger. In the illustration, B shows the burners, R reflector, P the supporting pin, C the clamping screw, N the gas nozzle, and T the tray.

Painting and Varnishing Street Door.—To get a satisfactory finish on a badly blistered door, the paint should be removed. Therefore, with a painter's blow-lamp fuse the paint, and scrape it off immediately with a knife or scraper. The door should then be thoroughly rubbed down with No. 1½ sandpaper to free it from inequalities, dusted well, and the knots painted over with patent knotting. Then apply a coat of priming paint made from 3 lb. of genuine white-lead and ½ lb. of red-lead, thinned down with equal parts of boiled oil and turpentine. The second or ground coat may be a dark grey or green mixed with boiled oil 3 parts, turps 2 parts, and when dry should be rubbed down with No. 1 sandpaper and dusted as before. Another coat may be given if necessary. The finishing coat should now be applied, which, for bronze green, should be made and mixed as follows. Bronze green paste paint 3½ lb., patent driers ½ lb., with boiled oil 3 parts, and turps 1 part. Then rub down lightly with No. 0 sandpaper as before, dust well, and apply two coats of hard outside copal varnish. If it is not desired to remove the old paint, remove the blisters and rub or flat down with pumice-stone, then apply two coats of green as above, and finally apply two coats of hard outside copal varnish, which will produce a bright glossy appearance.

Cutting Book Edges.—A bookbinder's cutting press without guide bars has its disadvantages, but it need not prevent the back of the book remaining level while being cut. It is quite usual, after having made the book perfectly flat, to pass a cord round it and draw the cord tight. The book then keeps flat and does not shift while being screwed up in the press. The usual procedure for cutting a book is as follows. The book, when sewn and with the end-papers put on, is glued-up, that is the back is glued and allowed to become dry. The book is then placed on the bench and looked over for the shortest leaf. Its measurements being taken with a pair of compasses, the book is closed, and two marks are made on the end-paper with the compasses, measuring from the back. A piece of cord with a slip-knot on it is passed round the ends of the book near the back and is drawn nearly tight. Then the book is taken between the hands and knocked up, the back being beaten on the press or any level surface. When the book is perfectly flat the cord is drawn tighter and made fast. Two cutting boards are now brought forward, the book is put on one of them, and the other is placed against the marks made with the compasses. The second board must have a perfectly straight edge, and is really the cutting edge. Next the book is lifted with the boards in the left hand, and carefully lowered into the press, which meantime is screwed up with the right hand. When the press is tight enough to hold the book, stop screwing and adjust the guide board carefully until it is quite level with the cheek of the press. To ensure the book and boards moving together, the guide board may first be slightly wetted by the tongue. The press is now screwed up tightly and the cutting done. When the fore-edge is cut, the back of the book is rounded and the ends are cut, but it will not now be necessary to tie up the book, as with ordinary precaution it will keep in a good shape.

Bakeboard.—A bakeboard is a very handy kitchen utensil that can be made in white-wood at little cost. Cut the bottom A (Fig. 1) of ½-in. or ¾-in. wood 24½ in. square. If wood of this breadth cannot be had, two pieces should be neatly joined. The back and sides B should be ¾ in. thick by 2 in. broad, the former being 24½ in. long, while the

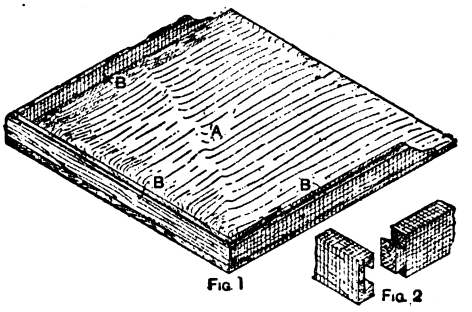


Fig. 1 Fig. 2

Bakeboard.

latter measures 22½ in. Square the ends of the back and sides which have to be dovetailed, and shape the other ends of the sides as illustrated. Cut the dovetails in the sides and back as shown in Fig. 2 and glue them together. Then plane the bottom smooth and round the corners at the front. When the frame is quite dry, plane the edges flush, and glue the bottom edges, fastening the frame to the bottom by 1-in. screw nails. Plane the projecting edges of the bottom flush with the frame, and round over or run a sash or ogee moulding on the top edge.

Filling for Cracks in White Enamel Leather.—A good filling for cracks in white enamel leather can be made by boiling well together ½ lb. of sugar, 1 oz. of gum, and 1 lb. of white-lead. Melt the sugar and gum first.

Coloured Washes for Brickwork.—Washes for brickwork are given below. Dissolve 1 lb. of powdered gum arabic and 2 lb. of concentrated size in sufficient warm water to make a mucilage, then add 8 oz. of powdered borax and stir all well together; the mixture should now be diluted with about 2 gal. of hot water, and the desired colouring, such as lampblack, yellow ochre, umber, and venetian red, added. This preparation, which, when dry, forms an excellent wash that is insoluble in water, should be well rubbed into the brickwork with a heavy distemper or pound brush. Another simple method is to mix together 2 parts superfine Portland cement, 1 part slaked lime, and 1 part lampblack, made into a wash, using stale ale as a binding agent. Apply as above. A very adhesive black stopping may be prepared by mixing together sharp sand 10 parts, lime 3 parts, litharge 2 parts, lampblack 2 parts; mix into a paste with boiled oil sufficient for immediate use, as the preparation rapidly hardens. Rub down the brickwork with linseed oil before using the stopping, which may be applied as ordinary mortar.

Cement for Uniting Indiarubber and Vulcanite.—Ordinary rubber solution, sold by dealers in cyclist materials, is suitable for uniting rubber and vulcanite. As vulcanite usually has a hard and somewhat smooth surface, the cement would adhere better if the vulcanite were slightly roughened by fine glasspaper.

Priming Paint for Woodwork.—The following is a recipe for a priming paint for new woodwork. Remove all roughness from the wood by rubbing down with No. 1 sandpaper, dust well, and apply a coat of patent knotting thinly and evenly over all the knots. A coat of priming paint made by mixing together 1½lb. of white-lead and 1lb. of patent driers, thinned down to the required consistency with equal parts of raw linseed oil and turpentine, should next be given. When priming hard woods as oak, pine, birch, etc., omit the driers and replace with 2lb. of red-lead. The ground coats may then be applied and prepared according to the finish required. The most economical and durable results are obtained by using the genuine or pure white-lead, the adulterated material producing inferior work.

Cutting Patterns for Right and Left Boots.—Some of the principles of pattern-cutting for right and left boots are explained below. The last which is used is supposed to be thick at the instep on the inside, the instep projecting over the waist, causing the back seam of the golosh to lean inside and the lacing at the front top of the vamp to appear to run to the outside at the toe instead of to the centre of the toe. The last described is of the type known as straight-inside, hence the upper running towards the outside, this being much longer from the centre of the heel to the tip of the toe than from like points on the inside. For such work it is best to cut the pattern of the golosh as described below, but in this case the projection will have to be allowed for, therefore it will be necessary to

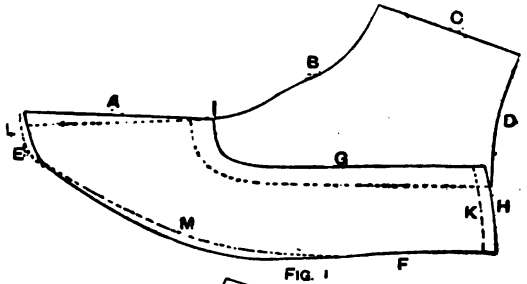


FIG. 1

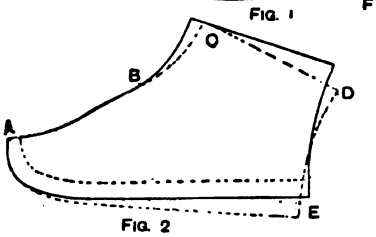


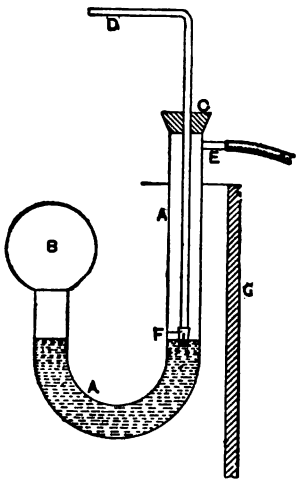
FIG. 2

Cutting Patterns for Right and Left Boots.

cut the quarter patterns for inside and outside. After cutting the ground pattern to the last and ankle and heel measures (see plain lines A, B, C, D, E, and F, Fig. 1), cut the golosh in the usual way as A, E, F, G, and H, but ¼in. longer and a little larger at E, as shown by the dotted line, but first marking the proper height of the vamp on the ground pattern at I. Try the golosh pattern on the last, and tack the centre of the vamp I on the centre of the front of the last. Draw the pattern round the outside at the back, bring the inside portion round, and mark it off from the centre of the back at an equal distance to the outside; see dotted line K. Then ignore the proper centre line at the toe, with the exception that ¼in. is to be taken off the inside back. Make the centre of the toe ¼in. from the proper centre to the outside of the toe as L, and fold it up to the centre I, as dotted in L I. Now place the golosh pattern back again, getting the point right at I, but letting it be underneath this time, and seeing that this new centre line is exact with the line A I, and trim off the toe to the top pattern at L E. Then from the bottom of the inside take off about ¼in. to the dotted line M (this is done to save leather in cutting). The quarter pattern is somewhat harder to explain, but is done similarly to ordinary pattern cutting, for although the front curves are different, thus throwing the top line and back out of gear, one curve must be equal to the other. Thus when the quarter pattern as just drafted (Fig. 1) has been cut, and produced by the pattern formed by the full lines in Fig. 2, place this on another piece of paper, and cut true from A to B; press the little finger very tightly on A, and the forefinger on B, and with the right hand draw the top point back to C. Hold the two there with the left thumb, only letting the little finger loose, and cut to the dotted lines B C, C D, and D E, being careful to note this last point. Then put A in place again and cut the bottom to A E as shown by the dotted line and the back line D E, true to the first pattern.

Using Gilder's Tip.—A gilder's tip is drawn lightly over the hair of the head or down the cheek, of which the natural oil is transferred to the tip, and causes it to lift the gold. But if the gold has been spread on a cushion, this must be perfectly clean and dry, and should be cleaned now and again by rubbing over with bath-brick or brick-dust. Then the dust is cleared off the cushion with the gold knife. The leather of the gold cushion should never be touched with the hands or brushed over with an ordinary brush.

Thermostat for Hot-air Incubator.—There is much greater difficulty in regulating the temperature of a hot-air incubator than that of a water-heated one, as it is more easily affected by fluctuations in the atmospheric temperature, and that is why an ether thermostat is too sensitive. An air thermostat (see accompanying illustration) will be found to be less sensitive. This consists of a U-shaped tube A with a bulb B on one limb and a cork C fixed in the other, with an entry tube D for the gas, and an exit tube E on the U. The entry tube has a minute hole in one side to keep a trace of gas always passing so that the flame never goes out; at the bottom is cemented the slit tube of a mapping pen F from which the nib has been broken. Mercury is placed in the U tube, and the gas entry tube



Thermostat for Hot-air Incubator.

is drawn out or pushed in until the required temperature is obtained. G shows a section of the corner of the incubator.

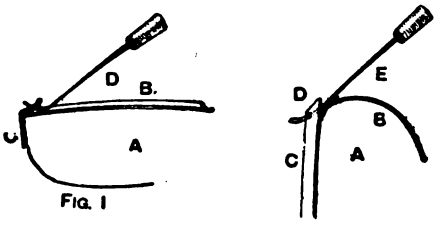
Setting Gem Rings.—In setting one diamond and four pearls in a finger ring, first drill the hole through for the diamond a little smaller in diameter than the stone. A bearing or seating for the stone to rest on is next cut by means of a medium size half-round scorper, taking care that the stone only goes comfortably in without shake. The holes for the pearls are next drilled just deep enough for the edges of the pearls to come a little below the edges of the holes; these holes are made with a flat-bladed drill or pearl drill. Having fitted all the stones, cut the side grooves, leaving small pieces of gold between the stones and one piece at each end. Place all the stones in position, and with the point of a strong spit sticker push over the edges of the stones the little pieces left. These pieces are next formed into grains by applying a grain tool on the top of each with a little pressure, working them into shape. The side grooves are then brightened by cutting them over again with a spit sticker, the back of which has been polished to give a smooth cut.

Cream for Black Leather Boots.—Below is a good cream for black leathers. Mix 1lb. of curd soap, 2lb. of beeswax, 2lb. of oil of turpentine, and 4½lb. of water, with black or any other colouring matter to the shade required. The soap should be cut up and dissolved in water by boiling separately. The wax should be dissolved in the turps by heating the two together. Pour in the soap solution and briskly stir until the whole is of a creamy nature and cool. Aniline colours should be mixed with the water before the soap is added.

Table Jelly.—For making table jellies gelatine should be dissolved in about five times its weight of water by a gentle heat, then about half its weight of sugar, a trace of colouring matter, and essence should be added; the jelly is then left till next day to set. It may be granulated by forcing it through a coarse sieve in a similar manner to mashing potatoes.

Enamelled Kettle Leaking.—For stopping a leak round the spout of an enamelled kettle, first scrape the metal quite clean and bright at the leaky part, and then apply some raw spirit. Rinse this off, and if the metal appears clean and bright, apply some killed spirits, and solder the part in the usual way. If the metal is not clean after rinsing the raw spirit off, continue applying the acid until the metallic surface is sufficiently clean for soldering purposes.

Ladies' Shoes with Pointed Toes.—In getting the sole and the upper quite close so that the sewing is completely hidden all round when making a pair of very pointed shoes with thin bevel soles, much depends on the fitting of the inner sole, which should not be feathered too narrow, or, when stitching the sole on, the stitches will be thrown just under the edge of the feather of the inner sole. The holing of the inner sole should be done so that the awl will come out just in the extreme recess that the feathering has made, and in sewing in the welt the sewing awl should not be too straight, but should be curved, so that when it is pushed through the upper after lasting the stitches will fall as near above this point as possible (see Fig. 1, in which A is the last, B the inner sole, C the upper, and D the sewing awl). After the sole has been rounded up and the piece bevelled off round the edge, the channel, as will be seen, will be somewhat farther in than for



Ladies' Shoes with Pointed Toes.

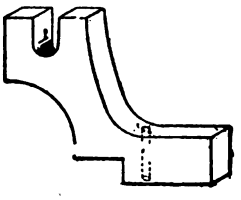
ordinary work. Thus it is obvious that the stitching awl will need to be straighter than usual to make the work easier (see Fig. 2, in which A is the last, B the upper, C the sole, D the bevel, and E the awl). Both Figs. 1 and 2 are transverse sections of the shoe. One other thing that will be helpful is as follows:—Just where the stitches would lie on the welt in stitching, with the point of a sewing awl scratch a very shallow channel in the welt. Then when the shoe is stitched, the channel pasted and set down, and the stitches are well rubbed down with paste or gum, the whole of the bottom can be well and evenly hammered down, and then the edge tapped down all round with the hammer to get it as close as desired.

Finding Time by 4-ft. Rod.—There may be some rough and ready way of finding time by means of a rod, but the following method is possible, though tedious. Stand the rod vertical and measure the length of its shadow. By taking the shadow length as radius and the rod as a tangent, the value of the angle of elevation of the sun can be calculated by the aid of a table of natural tangents. Thus in a rough and approximate manner the 4-ft. rod takes the place of a sextant as used in navigation, and by the same method that the sailor uses, the time can be calculated with the aid of a table of logarithms and an almanac.

Prize Medals.—White metal of which prize medals are made is cast in ingots, rolled out by machinery into sheets, then slit into narrow strips of the requisite width; these strips are highly polished, then cut by circular cutters into discs of the required size. These discs or blanks are then placed one by one on a steel anvil engraved with the design for one side of the medal, and a steel die with the design for the other side is brought sharply down on the blank by means of powerful machinery, thus making a clear, sharp impression on both faces at once. This method of making medals surpasses that of casting them in moulds. Unless the moulds are made of iron, engraved or sunk as a steel die is prepared, the production would be very rough, and the cost would not be less than the price at which the finished medals can be procured. A rough imitation of a medal may be made with a casting of the white metal in a plaster-of-Paris mould well saturated with linseed oil and baked enough to carbonise the oil in the pores of the mould. Or a better mould for the purpose can be made of Parian cement as directed in Series II., p. 350. No special instructions are necessary for gilding or silvering these medals. They are to be treated as pewter or Britannia metal, and electro-gilded or electro-silvered as may be required.

Clarionet Reeds.—For the high notes of a clarionet a hard reed is chosen, but for a song accompaniment, especially if in the lower register, a soft reed is to be preferred. But the curve of the mouthpiece and the strength of the player's lips are of equal importance in determining the choice of reed. A hard reed requires a closer "lay," or, in other words, a flatter curve and smaller space between the reed and the mouthpiece. If a hard reed is used on a mouthpiece suitable for a soft reed, the player's lips must bring the reed closer to the mouthpiece or else more wind will be required to play the instrument. If a closely laid mouthpiece is used for a soft reed, the pressure of the lips for the highest notes will probably close the aperture entirely. So it will be seen that not only must the compass and character of the music be studied, but the lay of the mouthpiece and the player's lips and lung power should have a determining influence. A better tone is obtained by a hard reed if all the other surroundings are favourable; therefore have the mouthpiece laid rather close, and choose the hardest reed that can be played easily. It is of great importance that the curves of the mouthpiece should be alike on each edge of the aperture.

Appliance for Smocking.—Doubtless there will be considerable difficulty in constructing a gathering machine for use on a sewing machine in smocking fancy work. But thin material can be gathered on



Appliance for Smocking.

an ordinary sewing machine by the use of a special foot shaped like the accompanying illustration.

Bottles Made from Bladders.—Bladders from which bottles are to be made should be thoroughly cleansed, both inside and out, with clean warm water and dried very slowly, rubbing in, from time to time, a small quantity of olive or castor oil to counteract the tendency to become hard. The necks, of tinplate or brass, should have two depressions or grooves, and on these the bladders are wired. Bladders may be suitable for spirits, but should not be used for water or solutions of any kind containing water. The membrane, being a highly nitrogenous substance, is rapidly acted upon by bacteria, which cause it to putrefy; and any liquid (except spirit, which is preservative) kept in the bladder would in a short time become so tainted as to be undrinkable.

Bending Split Tube.—To bend split tube, securely solder a strip of strong sheet metal in the open cut in the tube and along on each side, and then bend the tube round on a template of the desired shape. Tube that is 1 in. or more in diameter will probably have to be loaded with lead, or a composition of equal parts of resin and pitch, and then bent by any of the usual methods; after getting the tube to shape, unload it again.

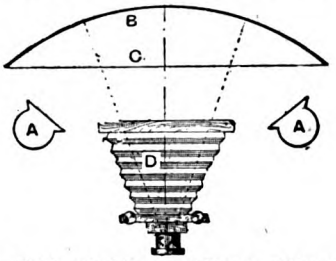
Needle Cotton Breaking in Pfaff Sewing Machine.—The cause of the needle cotton of a Pfaff sewing machine breaking at a seam may be that the needle is too small, or the material too hard. Try a larger needle, and soap the seams on the wrong side before sewing. The discs are connected by a stud which passes through the face-plate and engages with a long flat spring, which in turn is tightened by the tension screw in the top of the face-plate. To remove the face-plate, it is only necessary to take out the two screws that pass through the front. The operation of releasing the tension can be seen clearly when the face-plate is removed. A small releaser connected with the presser bar pushes out the stud and discs.

Coach Painters' Japan Putty.—Japan putty is made by mixing together equal parts of dry white-lead and whiting, and making into a paste free from lumps with gold-size.

Covered Wires of Grand Piano Breaking.—If, when attempting to replace broken covered wires in a grand piano, they snap during the process of tuning, probably it will be found that there is excessive side or downward strain bearing on a sharp arris edge of the tension stud situated at a point to form the top bridge. The stud through which the troublesome wire must pass should be removed to enable the stud to be slightly countersunk on both sides; a trace of dry blacklead in the hole and on the bottom bridge will also be an improvement. When tightening up the wire for tuning, before attempting to pull it up to the correct pitch, notice whether the tension extends the whole length of the wire. Careful observation will reveal that the string is not perfectly parallel, but dips downwards at each end—the tail end to fasten on the hitch pin, and the coil end to encircle the tuning peg. At the latter point it is expedient that the wire should not be twisted in its length or that one coil shall overlap the other.

Marking Glass.—For marking on glass use something softer than chalk. Pipeclay is often used, but soap is better; this can be easily cut into a convenient form for holding, does not scratch the glass, and can be readily cleaned off when no longer needed.

Enlarging Negatives without Condenser.—The best plan of enlarging is that shown in the accompanying illustration, where two lamps A are used to secure even illumination, and these lamps shine upon a sheet



Enlarging Photographic Negatives without a Condenser.

of cardboard B bent into circular form and held so by a thread C. D is the camera. The cardboard acts as a reflector. The exposure is of course considerably longer than when a condenser is used, but if the lens works at f/6 it will not be very prolonged.

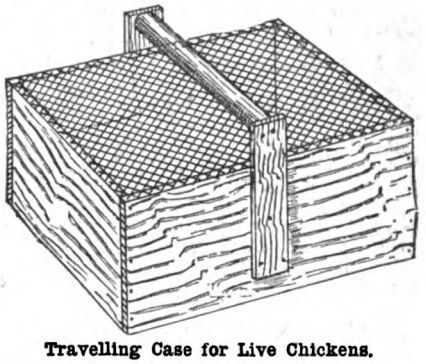
Artificial Hand.—There are two methods of making movable fingers for an artificial hand. The simpler method is to make them with mortise-and-tenon movement. That is to say, four slits are cut in the wooden hand as mortises for the lower thirds of the four fingers, and these have tenons cut on them to fit into the mortises. These joints are then carved and glasspapered until they work freely without being loose enough to shift with the weight of the fingers. The middle thirds are then fitted in a similar manner to the lower thirds, and then the finger tips. The thumb is mortised into the side of the hand. Steel pins hold the joints together. A kid glove covers the whole. Very little skill is required, and the only tools needed are a fine tenon saw, a narrow chisel, and a bradawl, together with a good pocket-knife. In the other method rule joints are used, and these require more skill in making and fitting. The best wood is willow.

Flexible Paint for Canvas.—Below is a recipe for a flexible paint for canvas. Mix 1 part of boiled oil, 3 parts of raw linseed oil, and 1 part of copal varnish, adding to obtain a flesh colour, 2 parts of yellow ochre and 1 part of venetian red paint. Apply it by means of a heavy brush, allowing one coat to dry thoroughly before applying the next. The drying may be hastened somewhat by hanging the canvas over a line in a room having a temperature of 110° F. By adding suitable pigments any colour may be obtained. For black, use lampblack; for yellow, use yellow ochre or chrome yellow; for brown, use vandyke brown or Turkey umber. The use of the pigments does not materially alter the method of applying the preparation. Another method is to melt 1 oz. of pure rubber in 1 pt. of raw linseed oil by boiling over the fire, afterwards adding ½ pt. of boiled oil and ½ pt. of carriage varnish; stir well together and add the colouring matter. Apply as before. If one coat of the preparation is not sufficient to give the desired effect, the operation may be repeated. Both of the above methods give satisfactory results and make the canvas elastic durable and quite waterproof.

Cementing Indiarubber Articles.—For repairing articles made of rubber, rough well with a rasp the parts that are to be stuck together, then with a clean brush remove all the dust. Now apply to each of the materials a coat of indiarubber solution (obtainable at any cycle stores), and when nearly dry (the solution dries quickly in dry or warm weather or in the warmth of a fire, but open-air drying is best) give a second coat, and then a third. The solution should be laid on evenly all over with the second finger, and in testing to see whether the solution is dry enough, use the finger, but only in the centre of the surface of the material, for if touched at the edges it will not adhere. The solution is dry enough when it just sticks to the finger without any coming off.

Essence of Coffee.—Essence of coffee may be made by boiling 1 lb. of coffee in 1 gal. of water in a copper still, the volatile oil passing over with the water through a worm. The infusion should be carefully filtered, evaporated to about one-fifth its bulk in a vacuum pan, and the volatile material from the original washing added to it previous to bottling.

Travelling Case for Live Chickens.—The illustration shows a wooden case for conveying from six to twelve chickens from one to four weeks old. The sides of the case are made of 7-in. by ½-in. deal, and for twelve birds the size inside should be about 1 ft. 4 in. by 1 ft., or for six chickens 1 ft. by 8 in., but this may be modified according to the breed and age of the birds. Two pieces of deal



Travelling Case for Live Chickens.

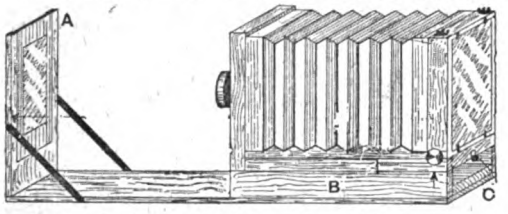
7 in. by 2 in. by ½ in. are nailed to the sides of the box to stand up 2 in. above the top, and a round stick is fitted between them to form a handle. The bottom may be of the same material as the sides, and both bottom and sides should be lined with soft canvas packed with a little hay. The top is covered with fine wire netting when the birds are being sent off, but in cold weather the top may be partly covered with coarse canvas. The handle in the position shown is useful for preventing other cases being placed on the top, and if desired holes may be bored in the side pieces and a piece of rope stretched across instead of the round wooden rod.

Cement Backing for Thin Copper Panels.—The operation of backing thin copper panels is one that will require considerable care, as the ornamental face of the panel is easily damaged. A cement that can be recommended is made of the best plaster-of-Paris mixed with water in which alum has been dissolved. The plaster should be sufficiently thin to run easily. Pour the fluid carefully over the back of the work, letting the plaster fill the hollows, and then level up the plaster to the desired thickness. This, when hard, will form an excellent cement backing. A mixture of pitch and sand also makes a very good backing, but must, of course, be hot when it is run into the panel.

Painting Mailcart.—The proper method of painting a mailcart is as follows. Rub all the woodwork with No. 0 sandpaper, dust well, and apply a coat of white-lead priming, made by mixing genuine white-lead with 2 parts of oil and 1 part of turpentine, and adding a little patent driers. Allow the priming to dry, then putty-up with putty made from equal parts of white-lead and ordinary putty. When this has thoroughly dried, again rub smooth with sandpaper, and dust well. Then apply a coat of spirit colour, made by mixing 1 lb. of the desired colour ground in turpentine, adding more turpentine until the required consistency is obtained, finally adding 1 oz. of gold size, or sufficient to bind the colour and prevent it rubbing off. Rub lightly with No. 0 sandpaper, and dust well, as before; then apply a coat of copal varnish; allow it to dry, and line it the desired colour with a coach-painter's lining brush, and finally finish with a coat of carriage varnish. This method will give a smooth and very brilliant finish that will be durable for a length of time, and that exceeds the results of applying the cheap enamels supplied by ironmongers.

Melting Gold.—Gold, either pure or alloyed, is melted in plumbago crucibles, either Morgan or Doulton. Before using the crucible, well rub the inside with flour charcoal to smooth down any irregularity in order that the gold may not be held in and lost. To anneal the crucible, place it in a furnace whose fire has nearly gone out, or else over a fire in a furnace, and weigh out the gold and other metals if such are being used. When copper is added, this must be placed at the bottom of the crucible and covered with a layer of charcoal to prevent undue oxidation. When the metal is well melted, stir with a clean plumbago or smooth iron stirrer; the metal is then ready for pouring. If only gold, which may contain slight impurities, is being used, a small quantity of sal-ammoniac should be added: this will purify and toughen the gold so that it may be well worked. The heat required to melt gold satisfactorily can be learned only by experience.

Brown Tones on Photographic Dry Plates.—The following is a description of the process by which brown tones can be obtained on a dry photographic plate. The plate, after the usual thorough washing, should be immersed in uranium nitrate 50 gr., potassium ferricyanide 50 gr., acetic acid ½ oz., water 10 oz. After a few moments' immersion the colour of the image will be changed to a warm sepia, and will change again to a bright red if the action is allowed to continue. On removal from the toning bath place the plate in a 1-in-80 solution of acetic acid for a few moments, and then wash in running water for half an hour. See that the potassium ferricyanide is in good condition, and wash it with cold water before dissolving. Dissolve the two salts separately, each in half the water, and pour the potassium salt into the uranium. The solution will not keep. A positive transparency to be used as a proof may easily be made from a negative by placing the negative and dry plate film to film in a printing frame



Apparatus for Producing Photographic Proofs Quickly.

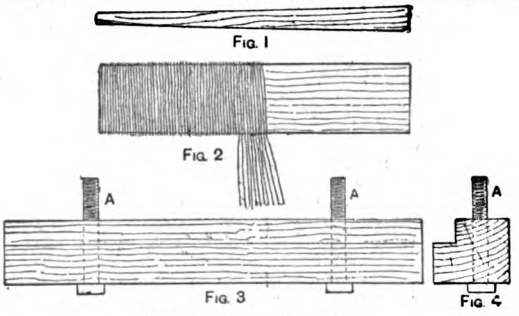
and burning a wax match 18 in. away. Develop in the usual manner. When a proof is needed before the negative has time to dry, the negative may be wiped on the glass side and slipped into a frame as shown at A in the accompanying illustration. The camera is then placed in the position provided on the rails B and extended to a point always marked (see arrow), when the image on the focussing-screen will be fairly sharp and of exactly the same size as the copy. Final focussing is done by a screw. The slide may then be filled with a plate or with bromide paper as desired, and the exposure made as usual. The distance between the image and the copy will be just four times the equivalent focus of the lens, or twice the focus between the stop and the copy and the stop and the image.

Inserting New Bent Side in Piano.—The crescent-shaped wood at the treble end of a piano, into which the hitch-pins are inserted, is commonly called the bent side. If this is much worm-eaten, it should be replaced by a new one; but this would necessitate nearly one-half of the strings being replaced, and the soundboard disturbed. If the decay is not very pronounced, its progress might be stayed by frequently saturating the side with wood naphtha, and then planting on an iron plate, with the hitch-pins riveted in positions corresponding with those now occupied in the bent side. A common fault of wood bent sides is their liability to pull off from the glueing, thus causing the treble end to get out of tune. Whether this is the case or not can be readily ascertained by trying to insert a table-knife behind the bent side and the bracings, to which it should be in close contact. If it has pulled away, remove all the movable parts of the piano, including the action and keys, putting them carefully aside to avoid damage. Then turn out all bolts or screws that are holding the bent side on, and slacken out all steel strings till they are free from tension likely to retard the cramps when being tightened up. The instrument should next be turned upside down, with its capping or top resting on the floor; then spring the bent side away at least ¾ in. by means of wood wedges, and with a table-spoon pour some hot

freshly made glue into the joint, working it well home with a table-knife. Both utensils should be previously dipped into hot water to prevent chilling the glue. Remove the wedges and put on as many cramps as possible, or if none of these are at hand, and coach screws or dowels have been used, immediately put in some ¼-in. bolts with their heads at the front and nuts and washers behind the bracings. Tighten up at once, then glue stout blocks of wood behind wherever it is possible to get them: see that these fit well, removing any old glue or varnish before fixing them into position. Then allow the instrument to stand untouched for at least twenty-four hours and then tighten up the wires again. Should it be found desirable to put in a new bent side or to put a plate on its face, a careful imprint of the present one should be made before it is disturbed. To do this, take a sheet of brown paper of convenient size, put it over the bent side, and rub gently over all with a cobbler's heelball until it shows a clear imprint of all hitch-pins and the outline of the wood required.

Obtaining Gloss on Ostrich Feathers.—To obtain a gloss on ostrich and other feathers after they have been dyed or cleaned, they are dipped in an emulsion of olive oil and pearlash, and then moved about in a warm room till they are dry. The emulsion may be made by dissolving 1 lb. of pearlash in 4 pt. of water and stirring this with 4 pt. of olive oil.

Packing Circular Saws.—Circular saw packing is made by twining clean hemp round two slips of wood. These slips should be equal in length to the radius or the semi-diameter of the saw, less the saw teeth. The packing rests on a rebate on each side of the fore half of the saw. The slip on the bevelled side of the saw should be tapered as shown in Fig. 1; the hemp is passed round the slips as shown in Fig. 2. Two pieces of wood, rebated as



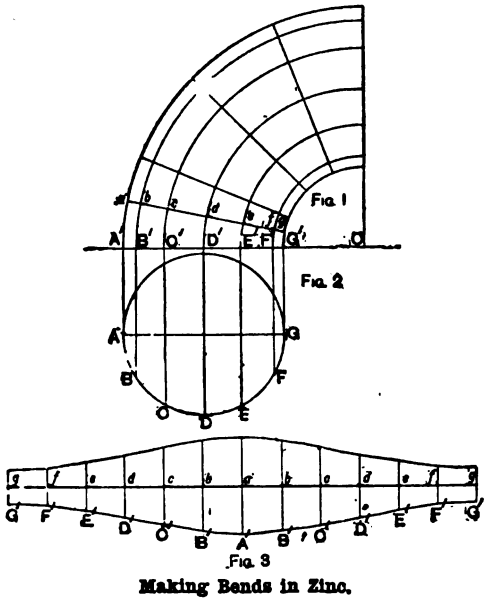
Packing Circular Saws.

shown in Figs. 3 and 4, are secured underneath the table of the bench by means of bolts A screwed into tapped holes. On these pieces the packing rests. The hemp is so passed round the slips of wood that more warmth is conveyed to the centre of the saw-plate (when passing between the packing) than at any other part. The warmth caused by the packing should decrease from the centre out; at, and near the rim, the plate should be cool. Undue heat on the outer part of the plate will cause the saw to run out of truth and to become crippled.

Penny-in-the-slot Gas Meter.—The penny-in-the-slot meter is made differently by various firms, but the principle of most is the same. A worm fixed on a shaft is free to travel axially upon the shaft, but when the shaft is revolved the worm must revolve with it. Connected to the worm and gearing with the threads upon it is a pinion, which can only be revolved by the handle when a penny has been inserted, and has thus formed a connection between the handle and the pinion. The turning of the pinion causes the worm to travel axially along its shaft, as the threads of the worm act then as a rack. In travelling, the worm opens the valve and allows gas to pass through the meter. The passage of the gas through the meter revolves the ordinary indicating mechanism, and this motion is also conveyed to the shaft of the worm through gearing which can be changed according to the number of feet of gas desired to be given for a penny. The revolving of the shaft causes the worm, which is in gear with the pinion, to travel in the direction opposite to that in which it was carried on the turning of the handle, and in this travel it closes the valve, and when the quantity of gas paid for has been consumed the valve is entirely closed and the passage of the gas stopped.

Preventing Rats Eating Leather.—To prevent rats from eating leather, make a paste of 1 part of verdigris and 2 parts of olive oil, and rub it well into the leather. This paste is poisonous and will be a preservative.

Making Bends in Zinc.—Square, obtuse, or acute angle bends in zinc are stamped and stocked in all diameters by big firms, and the machine-made bends are much cheaper than hand-made goods. To make a bend by hand in, say, four pieces, first draw a side elevation of the desired size, with the opposite ends making the desired angle, as shown by Fig. 1, also draw the plan of one end (Fig. 2). Divide the lower half of the plan into any suitable number of equal parts, as A B, etc. From each division point draw projectors to reach the ground line, and then using O as a centre, and with radius to A^1 B^1, etc., draw the arcs of circles shown on Fig. 1. Next divide the curves A^1 G^1 (Fig. 1) into a number of divisions, corresponding to the number of sections of which the bend is to be formed. Join these division points by straight lines, and subdivide the first section (Fig. 1) by the line *a g*. Now set off upon a straight line a number of equal divisions corresponding to those shown on the plan, as *a b c*, etc. (Fig. 3). The length of this line would correspond to the distance round the section on the line *a g* on the elevation. Through *a b c*, etc. (Fig. 3), draw lines at right angles to, and on both sides of the centre line. Take the distance *a* A^1 on the elevation, and set off on each side of the centre line of the pattern as *a* A^1. Take the distance *b* B^1 from Fig. 1 and transfer to the next stripe on each side of A^1 *a* on the pattern. Transfer each of the remaining divisions on the elevation to the stripes with corresponding letters on the pattern, and then draw a curve through these points A^1 B^1 C^1, etc., to form the pattern (Fig. 3). A slight allowance for lap should be made along one curve only, and also at one



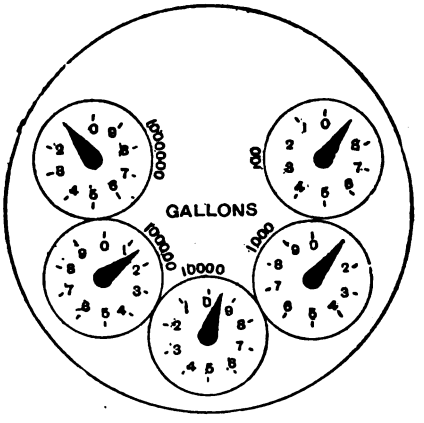
Making Bends in Zinc.

end of the pattern, so that when the section is bent round a lap seam could be formed. When making a bend of this type the sections are slightly hollowed upon a wooden block along their length, and after turning the section round, and soldering the ends together, a small edge is thrown off round one end, so that the section joining it laps over this small edge, and it is then soldered in position. The roughness at the soldered parts is removed by cleaning the spare solder off the zinc with a sharp scraper.

Softening Hard Photographic Enlargement.—In the case of a photographic enlargement being hard owing to under-exposure, it may be softened by reducing. If the original showed too great contrast, the enlargement should have been very slightly over-exposed in order to bring the higher and lower gradations closer together. A better negative would probably have been secured by giving the same proportional exposure but using a rapid instead of a slow plate; this would have had the effect of softening the contrasts. Advice on such matters is always difficult to give without an inspection of the negative; but possibly the best way of dealing with the existing negative (if another cannot be made) would be to coat the back of the plate with matt varnish and then scrape this varnish away from the dense parts of the plate. The bromide enlargement may be reduced either with ammonium persulphate, or by converting some portion of the silver image into silver iodide and dissolving out in sodium thiosulphate. The former method may prove the more effective of the two in unaccustomed hands, because being done in one operation there is less chance of error; and this reducer possesses the additional advantage of being the only one that attacks first the denser deposits of silver, and thus in reducing the image reduces also the amount of contrast. Soak the paper till it lies flat, and transfer to a 2-per-cent. solution of ammonium persulphate till the desired reduction is obtained. Then place the paper for five minutes in a 10-per-cent. solution of sodium sulphate, and finally wash for ten minutes. New developer gives an image of a better colour with increased contrast generally. The developer referred to will keep for a considerable time even after mixing with the alkali, but, in order to avoid obtaining images of a brownish colour, the developer should be discarded directly its action becomes noticeably slow.

Scents for Wardrobes.—With regard to scents for placing in wardrobes with clothes, ordinary scents are not very durable, as they are very volatile and easily evaporate. A lasting scent is that of lavender flowers, which may be kept on a small tray. Orris powder also gives a very pleasant odour.

Reading Water Meters.—The dial of the "Imperial" meter is here shown. The arrangement of pointer is similar in most meters. The reading commences with the circle to the left, which contains the highest figures, and the figure to be abstracted is the one beyond which the pointer has travelled. It will be observed that the pointers in the first, third, and fifth circles



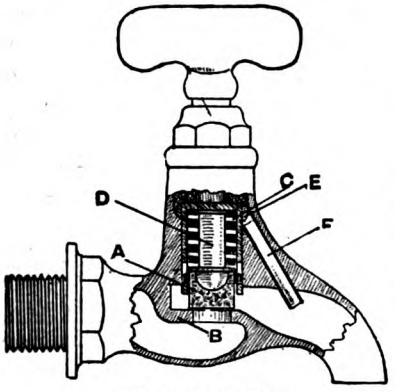
Dial of Imperial Water Meter.

move from right to left, and those in the second and fourth from left to right. The dial reading in the illustration is 1,190,900 gal. In the Kennedy meter the circles and pointers are in a row, like a gas meter. The Kent "Positive" and several meters have the straight reading dial.

Press for Extracting Liquids from Herbs.—A suitable hand-press for treating herbs can be constructed as follows. The base of the stand should be a wrought- or cast-iron plate 8 in. by 8 in. by 1 in. To this should be bolted at opposite sides a ⊓ shaped wrought-iron band carrying a female screw thread in the centre, through which would work a spindle having a thread; to the upper part of the spindle two handles should be attached for turning the screw. This portion of the press will be somewhat similar to a copying press. To the lower end of the spindle should be attached a circular cast-iron plate 6 in. in diameter; this will work within a sheet copper cylinder 6 in. in internal diameter. At the side of the copper cylinder, and near the bottom, a hole should be drilled, and just below this hole a spout should be soldered so that the liquid will flow out into a bottle below, the press being fixed on a wooden block of a convenient height to allow the bottle to be placed in the proper position. The herbs containing the spirit should be placed in the copper cylinder and pressure gradually applied. This is a common form of tincture press, but if difficulty is experienced in making it a lever would do in place of a screw. Or a simpler form of press can be made with a wood frame, the herbs being placed in a linen bag, and pressure applied by means of two boards placed in the frame and forced together by a wedge.

Roof Tiles and Tiling.—Plain tiles are rectangular slabs of burnt clay, generally about 10 in. long, 6 in. wide, and ½ in. thick. They are laid on fir laths nailed to rafters, being hung from the laths by oak pegs driven through holes near the upper edge of the tiles. Sometimes, instead of using pegs, little projecting cogs are formed on the upper edge of the backs of the tiles, by which they are hung on to the laths. The arrangement of the tiles is similar to that employed for slates; the tail of each tile rests upon the tile below for a length of about 6 in., the gauge being 4 in. and the lap over the head of the tile next but one below about 2 in. In exposed places each tile is bedded upon the one below it in hydraulic mortar or cement. Tiles require heavy roof timbers, as they weigh more than twice as much as slating—say 1,800 lb. per square against 700 lb. The larger tiles, called pantiles, are only used for common work; although larger, pantiles only weigh, when fixed, two-thirds the amount of plain tiling, owing to the smaller number of laps.

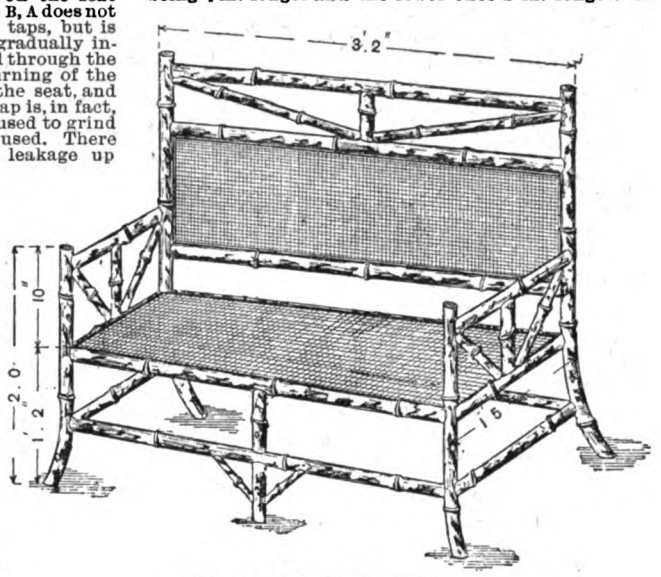
Kelvin Water Tap.—The illustration shows the mechanism of the Kelvin patent water tap. A is a composition valve or seating which closes down on the seat B to shut the cock. When A comes down on B, A does not come to a stop, as in ordinary screw-down taps, but is seated gradually, receiving meanwhile a gradually increasing pressure from the spring C, applied through the rounded head of the rivet stop D. The turning of the spindle revolves the valve or seating upon the seat, and both thus maintain an even surface. The tap is, in fact, a cock in which the seating and seat are caused to grind and true themselves every time the cock is used. There is no packing or stuffing box to prevent leakage up through the stem of the tap. Instead of this any water that passes upwards enters the space E, round the spindle of the tap, and is drawn away through the eduction or ejector tube F by the rush of the water through the nose of the tap. This tube is only used with bib cocks. With stop-cocks the ejector tube does not answer, and a stuffing box is provided. The chief difference, therefore, between this and other screw-down cocks is that the seating and seat, when they come together, do not stop dead, but the seating still revolves a little, and this has the effect of keeping the cock true and water-tight for a long period. The makers guarantee the cocks for three years, whereas, in a busy house, an ordinary tap will scarcely last one year.



Kelvin Water Tap.

Repairing Bellows of Pipe Organ.—For valves, a soft finish leather, and for strapping, a stout, strained skin are used. The glueing should be done in a warm place, and the leather of the bellows edges must be well rubbed down with a bone or ivory tool. Hot water and a sponge are used to restore warmth and to clean the work. Paper patterns should be cut for gussets, and the edges should be pared round the margins of the leather before glueing on. All woodwork that is to be covered with leather must have the sharp edges removed. All old leather that is to be replaced must be completely cleaned off, but first examine it carefully, to observe the order in which straps, angle-pieces, and gussets are fixed. In making feeders the ribs are first joined in pairs with linen tape outside, the joint and leather being inside. The top and bottom boards have a ¼-in. margin marked on; strips of leather are glued on so that the leather overlaps the edge of the inner surface, but has the ¼-in. margin of board unglued. This is done by applying the glue up to the line, the leather then being put in place and a warm flat-iron used to make the leather adhere where needed. The ribs are fixed temporarily, and the overhanging leather is glued over their edges. Another strip completes the joint. When all is done and dry, the gussets and corner-pieces are fixed. The inward folding ribs of the reservoir are done in the same way, but "inverted" ribs of the reservoir have the pairs of ribs joined together with tape on the inside. The valves should be made of stout soft leather, as two thicknesses of leather are apt to curl through the glue uniting them being affected by the weather.

Bamboo Settee for Garden.—The accompanying illustration shows a strong, light settee for both indoor and outdoor use. If it is to be exposed to all weathers, marine glue should be used in constructing it, and two coats of outside varnish should be applied instead of the spirit varnish used for inside purposes. The bamboo should not be less than 1¼ in. thick, and the back and front frames are made first, dowelled in the usual way, and are then connected by the six short rails as shown. The centre or seat rails of these will be 14 in. long, the upper ones being ½ in. longer and the lower ones 1 in. longer. In putting in the centre front leg the dowel should go right through the lower rail into the top one, and the corner supports are put on after. The seat, which will be 35 in. long by 14 in. wide, is of ¾-in. board, and will require a batten screwed on at each end on the under side. The back panel will be 35 in. long by 11 in. wide, and is also of ¾-in. board, and this and the seat are covered with Chinese matting, secured in place with 2½-in. screws through the rails, and beaded with ½-in. split cane. Turned wood terminals are then put on on the four top ends.



Bamboo Settee for Garden.

Manufacture of Wood Matchboxes.—In making matchboxes of the "drawer" type much machinery is used; the wood is taken on to the machines in the green state as it comes from the forest, and cut into planks that are as thick as the box is to be long. Thin veneers are pared off from the planks by a specially designed machine; each slice of veneer, or "skillet" as it is termed, is immediately conducted under a sprocket-like appliance which cuts off portions the correct length for a box, and at the same time scores four lines across each section at the places where the corners are to be bent up. The actual folding and covering with paper is in most cases done by hand, but there are several machines in which these processes are done mechanically. The round matchboxes used in the United States are turned by machinery, one machine making the box and another the covers, though either machine can be gauged to make boxes or covers. Each machine can be made to turn out about 10 gross items in an hour. The boxes are taken from the lathes and rattled in a revolving cylinder, which cleans and polishes them and separates them from chips, etc. The wood used in these boxes has previously been kiln-dried.

Laying Linoleum on Rough Floors.—When laying linoleum, etc., on rough floors, wood or stone, put down in the first place a liberal layer of ordinary sawdust, taking care that there are no chips of wood or any other rubbish among it. The sawdust may be spread roughly by means of a lath of wood. The linoleum is then put on the top and fastened at the edges in the usual way, and after a short time the sawdust will work its way into the hollows and the result will be a perfectly level surface. This method gives a softer feeling than if laid direct on the floor. In fixing linoleum it makes a better job to glue the edges than to use tacks. If good thick warm glue is used it will stick sufficiently well either on stone or wood, and the linoleum can be lifted when wanted without tearing it.

Table Extension for Table Tennis.—The following is a description of an extension made to an old mahogany dining table to render it of suitable dimensions for table tennis. The upper portion of the top A in the illustration is made of match-boarding of suitable size and of the same thickness as the table to which it has to be attached. This board may be painted or stained to match the colour of the existing table. Only two legs B are required, and these fit into sockets C glued or nailed to the under side of the board as shown; thus the legs can be removed. The two connecting bars D should be of hard wood, 6 in. by 1 in. by ¾ in., having holes about ¾ in. in diameter. The holes through which these bars are screwed to the table-top E are about 2 in. from the edge, so that when not in use

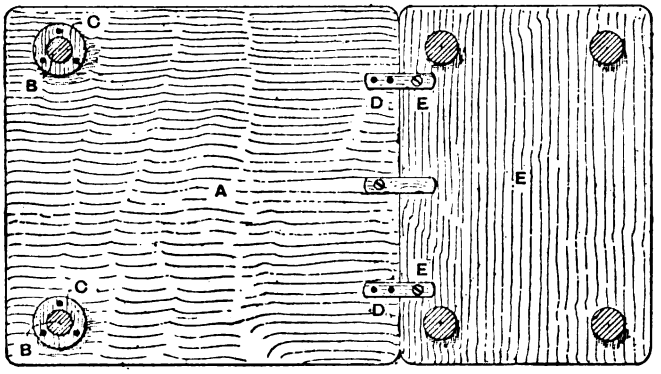
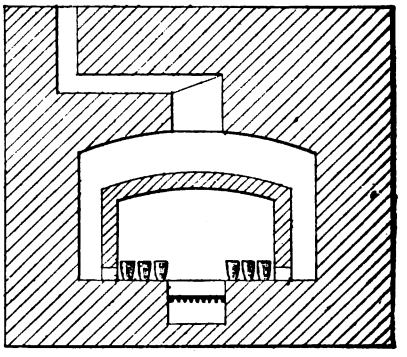


Table Extension for Table Tennis.

the bars may be turned round underneath the table, and thus be out of sight. They should be 2 in. from one end of the bar. The other holes should be 1 in. and 2 in. respectively from the centre of the bar, and are for the reception of the projecting pins in the under side of the extension A. The middle bar should be 4 in. by 1 in. by ¾ in., and is pivoted on the under side of the extension. To connect the extension A with the table E, turn the bars D round so that they project at right angles to the edge of the table, and in the holes insert the projecting pins of the table extension. These pins may be screw nails with their heads cut off. Turn the middle bar round so that its outer end may overlap the under side of the table; thus the two parts will be rigidly held together.

Reproduction Half-tone Process.—The photographic half-tone process of reproducing photographs, wash drawings, etc., is one that is outside the scope of amateur work except for experimental purposes. Blocks are now made commercially at a price considerably lower than they can be made occasionally, and certainly with more satisfactory results. Briefly outlined the process is as follows. From a silver print a copy negative is made on a process plate or by the wet collodion process in order to get a negative showing extreme contrasts with clear shadows, as the tendency of the process is to give a flat result, particularly in the lighter tones. In front of the plate, at a distance that is readily adjustable, is placed a glass plate ruled with lines (generally about 100 to 150 per inch in magazine work), the number per inch depending upon the method of printing and the paper that is to be used. This glass plate is technically called a "screen," and its function is to split up the tones of the photograph into dots of varying size—that is to say, each opening between the lines forms on the plate a pinhole image of the stop. In the lighter portions the dots are small, and in the shadows larger and therefore closer together. A bichromated film of fish glue on a slab of zinc or copper is then exposed behind this negative and the soluble parts afterwards removed with warm water, as in the carbon process, leaving those portions of the zinc beneath the shadows of the negative covered by an insoluble film. The plate is then stood aside to dry, and afterwards heated to such a temperature as to make the fish glue acid-resisting. The plate is then etched or eaten away by an acid to the proper depth, and trimmed and mounted on a wooden block type high. A certain amount of handwork bestowed both on the original and on the block by a skilled worker is an improvement.

Animal and Bone Black.—Bone black has a variety of uses, but is chiefly employed for decolorising sugar, and for the manufacture of paint and blacking. The black is prepared by calcining or charring bones in a closed vessel. There are two processes, one for collecting the volatile products, and the other to allow the volatile products to pass over. The latter process is almost entirely used, as the oil collected in the former process is of no practical value. The oil obtained is known as Dippel's or bone oil, which is used on the continent for denaturing alcohol (methylated spirit). In preparing bone black by the second process, the bones are first broken by machinery into small fragments and placed in small clay crucibles, having a cover placed over to prevent the black from igniting. In these covers are small holes to allow the volatile matter to escape. The crucibles are then placed in the furnaces ready for charring. Any kind of furnace will answer for heating the crucibles. A sketch of a furnace much used for this purpose is shown herewith. The furnace



Furnace for preparing Animal and Bone Black.

has a large flat hearth about 20 ft. long by 14 ft. wide, in the centre of which is fixed a fireplace, which is arranged to be fed from the outside; a firebrick arch is built over the hearth, at the bottom of which are a number of flues to carry away the products of combustion. Doors are also built in the sides of the furnace to admit of the furnace being charged and emptied. The number and sizes of crucibles vary according to the size of the furnace, twenty being about the average charge at most works. When the crucibles are placed in the furnace, the doors are secured and the temperature is raised slowly to a red heat, which is maintained for about seven hours, after which the furnace is allowed to cool down. The crucibles are then taken out and allowed to get quite cold before opening them, otherwise they are liable to ignite spontaneously, leading to a loss of material. When the furnace is emptied, it is ready for a second charge before it is altogether cold, which is a saving in fuel. Two and sometimes three charges of black may be obtained in one day, each charge being from 5 to 10 cwt. and yielding from 50 to 60 per cent. of its weight of black. The black when taken from the crucibles is ground very fine under flat stones with water, after which it is dried and powdered ready for use. If preparing it for decolorising purposes, it is ground into coarse granular pieces. Its chief use is in blacking manufacture, owing to it containing large quantities of calcium phosphate and carbonate originating from the mineral constituents of the bones. It may be mentioned that the spent black from sugar refineries would, if powdered, be found the cheapest form of black, its price being from £5 per ton.

Preservative for Studwork in Roughcasting.—Studwork is sometimes coated with raw oil, creosote, black varnish, coal tar, carbolineum avenarius, and Stockholm tar. All these preparations act as preservatives. The question is simply one of cost and appearance. Stockholm tar and raw oil will be found most effective.

Soldering Leaded Lights Together.—For soldering the calmes of a lead-light window, all that is necessary is to fit the calmes properly together, then shave a small round dot at the point of junction, sprinkle a little powdered resin on the shaving, and with a copper bit, or a glazier's iron with a tinned face, melt a small piece of tinman's ordinary solder on the shaved part so that it tins to the lead and forms a round button.

Combined Summer-house and Studio.—The illustrations show the construction of a combined summer-house and photographic studio, suitable for small gardens. The size is 6 ft. 6 in. by 6 ft. 6 in. by 7 ft. high to the plate, the roof rising 2 ft. 6 in., including the capping to the ridge.

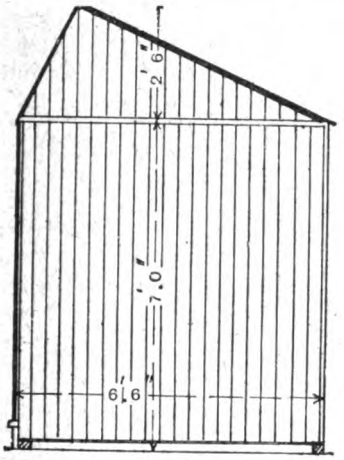


FIG. 2

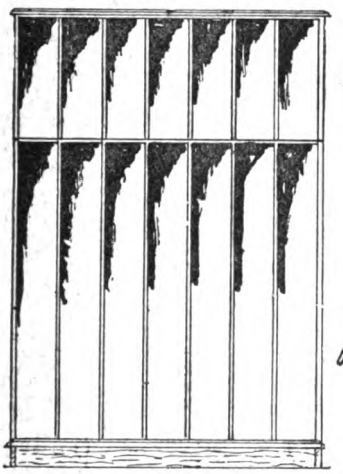


FIG. 3

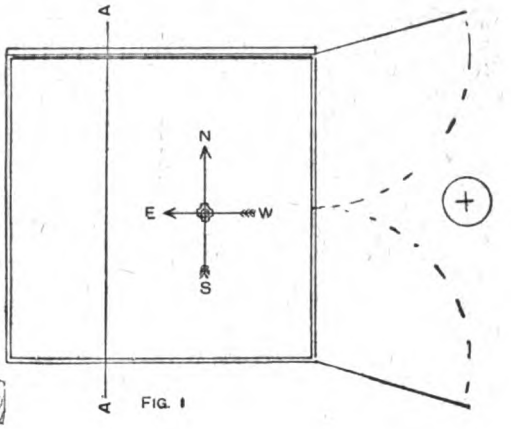


FIG. 1

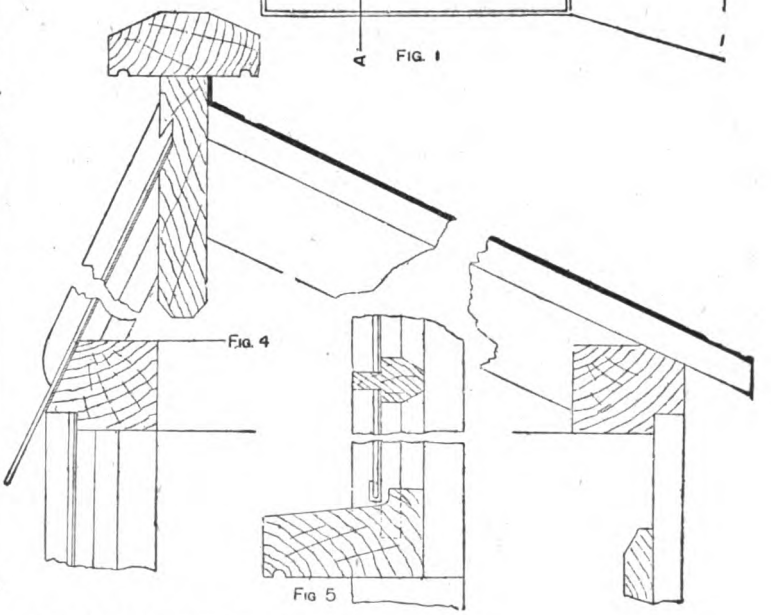


FIG. 4

FIG 5

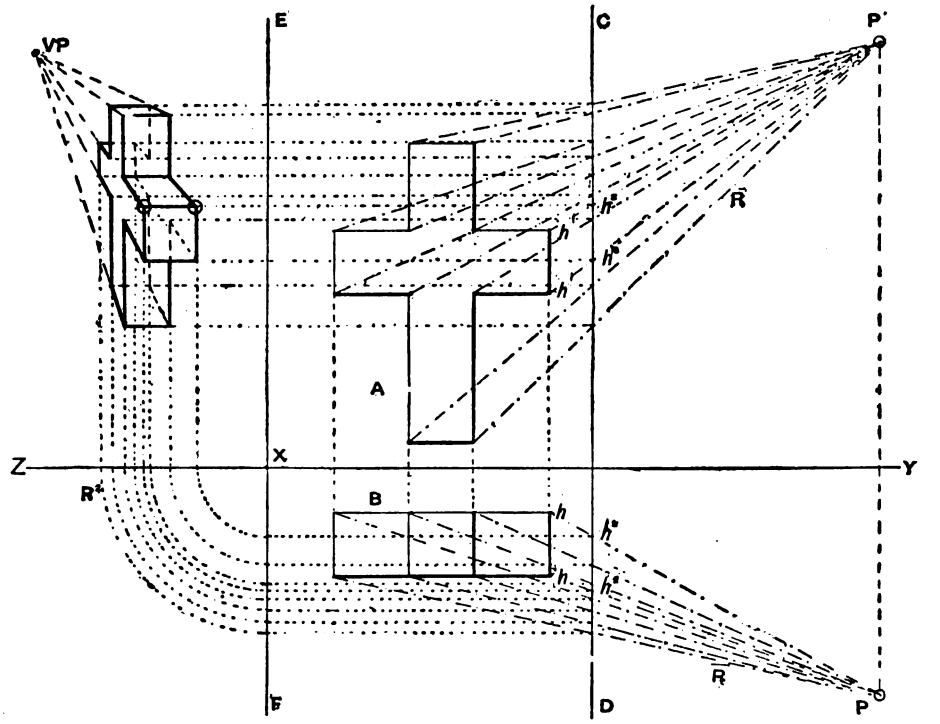
Combined Summer-house and Studio.

The proper position for the house is as shown, the roof and side lights having a northern aspect. On the western side a pair of doors is arranged to open outwards, the position of the operator and camera being indicated by the cross enclosed in a circle (Fig. 1). The side light runs down to within 6 in. of the floor. The sides of the house are covered with ¾-in. matchboarding, the doors being made of similar material with ledges on the inside. The roof is covered with matchboard and felt, or, instead of the latter, light corrugated iron may be used. If the house cannot be placed in the position shown, the situation may be reversed, but the light should always be obtained from the north if possible, otherwise the inside must be fitted with blinds to subdue the light. Fig. 1 is a plan of the house, Fig. 2 is a section on line AA (Fig. 1), Fig. 3 is an elevation facing north, Fig. 4 is a detail of the roof, and Fig. 5 is a detail of the sill to the side-light.

Quick-drying Black Paint for Stove Pipes, etc.—Brunswick black and black japan will be found useful for stove pipes and similar work. If slightly warmed over a fire and applied hot, it will dry hard in a few hours with a good gloss. The following preparation will be found inexpensive, and easy to prepare; also it dries hard, and does not smell when used on heated surfaces. Melt in an old iron vessel 4½ lb. of asphaltum, allow it to remain over the fire about an hour, stirring at intervals; then add slowly ½ gal. of boiled linseed oil which has been previously warmed, following with ½ lb. of finely powdered litharge, which should be steadily sprinkled in while continually stirring. Allow the preparation to boil about half an hour until some, when taken out and slightly cooled, sets hard between the fingers. Then remove the preparation from the fire, allow it to cool somewhat, and add, while constantly stirring, 2½ gal. of American turpentine. Allow the mixture to stand several days, when it will be ready for use. This preparation dries hard in two or three hours with a hard, lustrous surface.

Rubber Tyres Cracking.—With regard to the treatment of cycle pneumatic tyres that are cracking near the rim, if the rubber is not worn out on the tread of the tyre, thoroughly clean round the edges where cracked with a brush and benzoline. Then brush into the cracks thick rubber solution, and, when dry, dust over with French chalk. This will keep the wet from the canvas lining until the rubber coverings of the tyres are destroyed to such an extent that re-rubbering is the only possible repair.

Finding Perspective of an Object.—The following is a very simple method of finding the perspective of any object. The plan and elevation of the object (in this case the object is taken to be a cross) are obtained as shown by A and B, and the position of the eye is marked at the required distances from the vertical and horizontal planes as indicated by P and P^1. Every point is then connected to the eye in plan and elevation as shown by the lines R and R^1 and the position of the picture plane inserted at C D. An auxiliary picture plane is then put clear of the plan and elevation as shown at E F. This plane is not absolutely necessary, as the rays could be swung round from the original picture plane, but then the perspective would overlap the elevation and cause confusion. The points where the rays R in plan cut the picture plane C D are then projected across to the plane E F and swung round to the ground line as R^2, the centre of the curves being at X. Then the points where the rays R^1 (elevation) cut the picture plane C D are projected horizontally to intersect the vertically projected rays R^2. The correct points can easily be determined by following each point carefully. For instance, the four points represented in plan and elevation by h and h^1, are connected to P and P^1 and intersect at h^2 and h^3. Take the top points h^1 and project across to cut the projections of the two points h^2, thus obtaining the two points encircled in the perspective. The two lower can be obtained in the same manner, thus forming the square in the perspective. All the other points should be obtained in a similar manner and the whole object then filled in. In the illustration there is only one vanishing point, V P.



Finding Perspective of an Object.

Gelatine Capsules.—For making gelatine capsules, the necessary appliances are a mould and cores or plugs to fit it. The mould should be made of brass, but a wood one might serve for trial. It should have several (say two dozen) holes bored in it, each hole having the diameter and depth of the capsules required and being rounded at the bottoms. The plugs should be made $\frac{1}{64}$ in. less in diameter, but of the same shape. The gelatine should be dissolved in about an equal quantity of water and, while hot, poured on a polished marble slab and allowed to cool. When set it should be cut into convenient sized pieces, allowing for shrinkage, the amount allowed being determined by experience; the pieces should then be dried in a warm place. Previous to moulding, the gelatine should be softened by steaming, placed over the holes in the mould, and forced in by the plugs. After about an hour the gelatine will be set; the plugs may then be removed, the excess of gelatine shaved off with a sharp knife, and the cases shaken out. The capsules are usually double, one sliding within the other; this will necessitate two moulds, one with holes about $\frac{1}{64}$ in. smaller than the other. If wood moulds are employed they should be oiled to prevent the gelatine sticking.

Hardening Plates of Lawn Mower.—The method of hardening lawn mower cutting plates depends on whether they are of English or foreign manufacture. The majority of English plates are made somewhat similar to a skate-blade—that is, with a layer of iron between two layers of steel. To harden such plates, get them to a blood-red heat, grip them in the centre with a pair of close tongs, and plunge them in the water edgeways, moving them about till cold, but taking care to move them so that they go through the water edgeways. In this case the layer of iron helps to keep the blade to its original shape. The majority of foreign plates are made of a different kind of metal, and to harden them without warping they must be cramped between two pieces of iron, made hot, and cooled out as in the former case. It is no drawback to a plate if it is slightly warped, for with a little packing when being screwed on it can be brought perfectly true. Some repairers do not trouble to re-harden the plates, as they can be obtained very cheap ready hardened.

Re-wiring Spring Mattress.—Re-wiring a woven-wire spring mattress is practically the same job as making a new mattress. First the wire is stripped off and a new web is woven. Specially prepared tinned hard-drawn wire for wire mattress making costs 20s. per cwt. It is coiled in long ribbons of various pitches as required by a mattress-weaving machine, and is then worked in single, double, or treble layers on a large bench till the desired width is obtained. The wire web is then nailed on the end bars of the mattress frame and pulled up tight by the cramp bolts. Chain-spring mattresses are not as durable as woven wire, being much cheaper; they have no means of adjustment for taking up sagging, and are usually fitted to iron frames, each chain or spring wire being sprung into position and secured to the frame.

Selenitic Lime for Plastering.—Selenitic lime is sulphate of lime added to ordinary lime; the advantages of its use are that the setting is made more rapid, and the proportion of sand that may be added is increased. In three-coat work, for the first coat the proportions are 1 part lime to 3 parts clean, sharp sand; for the second or floating coat, 1 lime to 4 sand; for the third or setting coat, 2 lime to 3 sand, with a hod of ordinary lime putty to each bushel of selenitic lime. The only precautions to take are to mix in small quantities, and apply speedily.

Gymnastic Horizontal Bar for Passage.—Figs. 1 and 2 show front and side elevations of a simple arrangement for fixing a horizontal bar in a passage. Two such uprights will be necessary. The wall piece A lodges on the top of the skirting, and is lengthened out by a piece B, the two being securely screwed together. The two slides C should be bored as shown. Each of them should then be secured to the wall piece by half a dozen 3-in. stout screws. The blocks D should next be bored to receive the end of the bar, and also

Gymnastic Horizontal Bar for Passage.

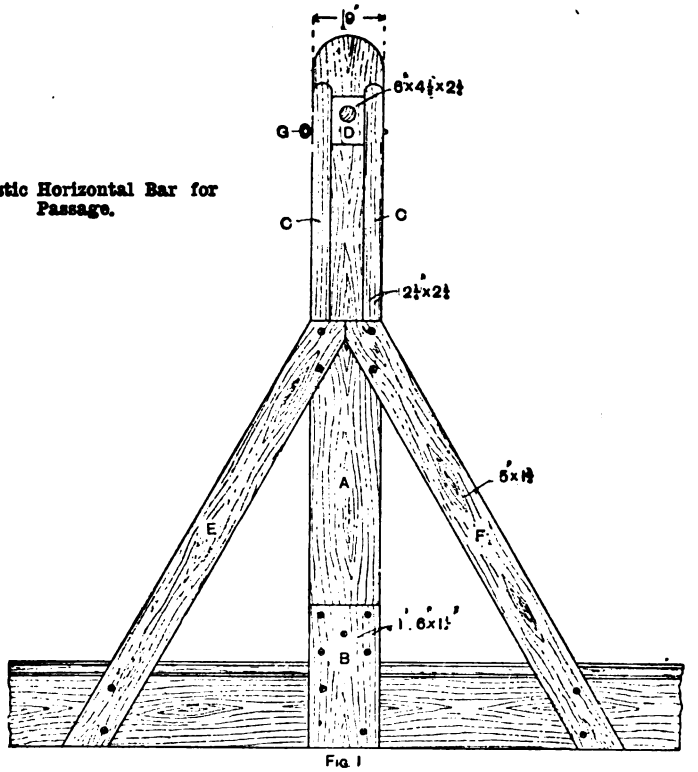


FIG. 1

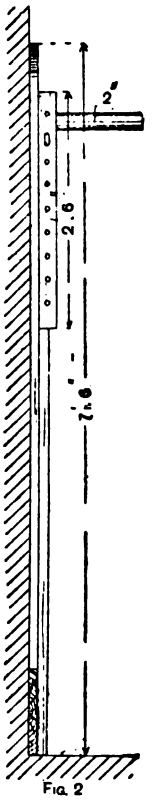


FIG. 2

bored right through their breadth, so that the bar can be held in position by the iron pin G. Two struts, E and F, must be fixed to the wall board with screws. The whole support can then be attached to the skirting of the passage by six stout screws. If it is desired to make the uprights more portable, so that they can be quickly removed, they can be connected to the skirting by means of thumbscrews. The wall board should be of red deal, the slide pieces and adjustable blocks of ash, beech, or oak, and the bar of ash.

Turpentine.—American turpentine, commonly known as spirit of turpentine, is obtained from several species of pine trees, which grow abundantly in the forests of the United States, principally in Carolina and Georgia. The Georgia pine yields the largest quantities of turpentine. During the winter months incisions about 3 in. deep and 9 in. from the ground are made in the tree, and from them the resin flows into suitable receptacles. This resin is commercially known as gum thus, and in its crude state is much used in the preparation of spirit varnishes and polishes; the bulk of the resin, however, is placed in stills for the manufacture of turpentine, after which it is known as "resin" or colophony, which comes to the market in various shades ranging from "pale glass" to black resin. To extract the turpentine the crude resin is placed in stills holding about 70 gal. It is then heated until a temperature of 275° F. is reached, when steam is blown into the still. The turpentine begins to pass over and condenses with the water by being sent through a spiral or worm condenser, and is then run off into large vats or tanks, the water being allowed to settle to the bottom. The clear turpentine is now run off and if necessary subjected to further distillation. Chemically, oil of turpentine consists chiefly of a hydrocarbon named pinene, and also contains traces of oxidised compounds and organic acids. One of its many peculiarities is that it rotates a ray of polarised light to the right, whilst the other turpentines—French, Russian, etc.—rotate it to the left, these facts often being used in a practical method of distinguishing one oil from another. After exposure to the atmosphere, oil of turpentine becomes slightly thicker and of a higher specific gravity. The organic acids it contains will often cause corrosion of the iron receptacles containing the oil. Turpentine has the property of giving up the oxygen it has absorbed to other bodies inclined to become oxidised, and in recent researches has been found to absorb one hundred times its own volume of oxygen at 100° C., thus becoming an excellent factor in the preparation of varnishes. Owing to its high price, there have been in recent years many attempts to prepare a substitute, but all have been more or less unsuccessful. Amongst the substitutes were compounds or fractional distillates from petroleum, benzole, coal-tar naphtha, shale, and resin spirit, which were mixed in variable proportions with the French and American turpentine, and were sold under various names, as patent turpentine, turpenteen, Chinese turpentine, turpentine oil, etc. They were produced in a highly rectified form, particularly the so-called Russian turps, which, by skilful mixing, was made of a specific gravity almost identical with that of pure American turpentine, and also with high flashing points. These substitutes, however, dry badly when mixed with paints or used in the preparation of varnishes, the work, after being executed, remaining sticky for an indefinite time, because the benzole, petroleum spirit, etc., fail to absorb oxygen from the air. Adulterants are easily detected in the laboratory, but the painter and dry-salter may test a suspected sample by slightly warming it and comparing the smell with that of a standard sample of pure American turpentine treated under similar conditions.

Paste for Labelling Tin Boxes.—The following is a satisfactory recipe for paste to be used in labelling tin boxes. Make the paste in the same way as the ordinary flour paste, but use syrup in place of water. Make the syrup by boiling two or three large teaspoonfuls of West India sugar in a teacupful of water; when the syrup is cold stir into a small quantity of syrup sufficient flour to form a paste of the consistency of cream. To this add some boiling syrup and stir vigorously; now boil the mixture and continue stirring until the stick or spoon used will stand in the mixture; lastly add from eight to ten drops of carbolic acid to prevent the paste becoming mouldy.

Octagonal Table.—Fig. 1 is the side elevation of a small octagonal table whose height is 2 ft. 5 in. The table top is made from ¾-in. stuff and may be shaped from a piece about 18 in. square, Fig. 2 showing the underneath plan. A piece about 16 in. by 5 in. by 1½ in. is mortised and shaped as shown at A (Figs. 1 and 2), and is fastened under the top by means of eight screws. A block 2 in. thick, shaped from a piece about 12 in. square to the form shown in Fig. 3, has also a mortise in its

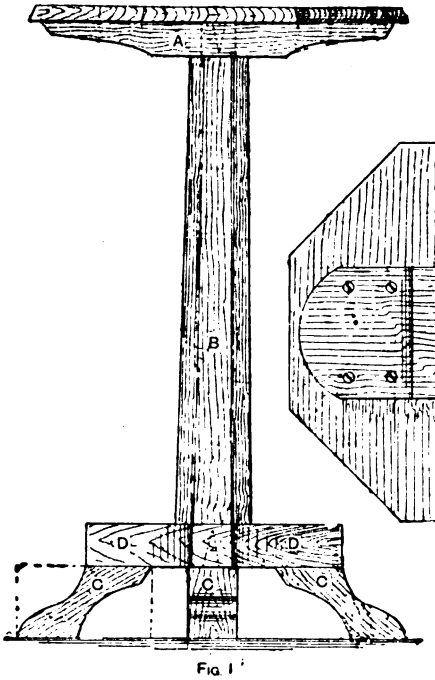


Fig. 1

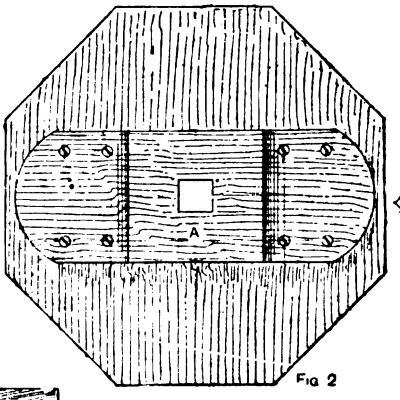


Fig. 2

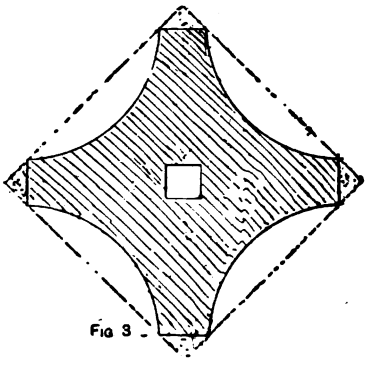


Fig. 3

Octagonal Table.

centre. The mortises in Figs. 2 and 3 are to receive the tenons shown in the pillar B (Fig. 1). This pillar is octagonal, and tapers from 3½ in. at the bottom to 2½ in. at the top. The tenons are driven snugly into the mortises, and well wedged and glued. Four feet C (Fig. 1) are made from short ends about 2 in. thick, and are secured to the block D. The table may be made from any kind of wood, and if of soft wood will look well when stained to imitate hardwood. Then apply two coats of size and two coats of varnish.

Glazing Carbon Prints.—In making carbon prints, if the glazed side of an opal is used instead of the ground side the prints will leave the opal with a high glaze. The surface of the opal must, however, be free from the streaks and flaws often met with on the reverse side of ground opal. Glass may be used, but in such case when to stop development is not easily judged without removal from the bath. Opal glass known as "flashed opal" answers best, but is sometimes difficult to procure. Opal glass specially smoothed can be obtained to order of most dealers in photographic materials. Whether glass or opal is used it must be first waxed with a solution of pure wax 5 gr., pure benzine 1 oz. The wax solution is rubbed over and then polished off with a piece of oiled paper. The glass is then coated with the enamel collodion in the same way as a negative is varnished, and, having set, it is then washed until all greasiness has disappeared; this is done to get rid of the two solvents, alcohol and ether. The enamelled plate is next laid face up in a dish of cold water, and a sheet of the printed tissue (somewhat smaller than the plate) is also immersed. The two are withdrawn together (face to face) in the usual manner, laid on the mounting slab, and squeegeed by gentle, firm pressure into close contact. The plate is then developed in the ordinary way, fixed, washed, and squeegeed into contact with its final support. Stand to dry in a well-ventilated room, and when perfectly dry the print and collodion will leave the glass together; should the print appear to stick, run a knife along under the extreme edge. If any difficulty is experienced in stripping, either the print is not perfectly dry or the glass has had an uneven and too thin application of wax.

Cleaning Waterbury Watch.—In the older class of Waterbury watch, that is, the long wind, on removing the case at the back the words "Don't remove this unless you are a practical watchmaker" will be seen. Now the only reason for this warning is that the very long mainspring may fly out all over the room. Therefore hold the cover down with the thumb until the three screws are removed; then gently lift it so as to slip the blade of a knife across to keep the spring in position. When taking away the cover, look at the outer coil of the spring to notice particularly how it is arranged to act as a stop when the watch is wound up. Then unhook the spring in the centre or inner coil. To save two wheels an exceedingly long spring is used. Before unscrewing the movement top plate, examine it well, especially the duplex escapement, and after it is well brushed and cleaned, the pivot-holes are cleaned with pointed pegwood. Replace the few wheels in position and put on the top plate, getting the largest wheel pivot in first, next the one that stands the highest, and so on. The 'scape wheel when at rest must point a tooth at the groove in the bar of the balance, and will be in beat. If not, unpin the hairspring and move it; then with best watch oil lubricate each pivot-hole at the top and bottom, a drop doing all that is required. Test by pressing the large wheel to see that it beats all right, replace in the case, then the mainspring, and fix the outer coil. Also refix the inner cover with the three screws, replace the hands, which are simply pressed down, drop one spot of oil on the centre at the back, and replace the outer cover. The short-wind Waterbury is easier to clean. By removing the small screw which holds the stem winder in position and the other holding its movement in the case, the work can proceed as already described, except the mainspring, which is in a barrel as in an ordinary watch. There are two more wheels, on account of the shorter spring. Clean well the escapement as above and replace, when either watch will go well. These watches are good time keepers as a rule.

Removing Gloss from Silk and Satin.—Gloss produced on silk or satin by pressing when making up the garment or occasioned by moderate wear, may be removed as follows. Dissolve a small quantity of powdered ammonia in hot water, allow it to cool (or weaken Scrubb's cloudy ammonia by adding cold water), and in this dip a piece of silk or clean sponge, and with this damp the surface of the material. Next take a moderately heated iron, lay it on its side, cover it with a damp rag, and allow the steam produced to play on the back of the glossed material. The foregoing plan may be safely followed for light as well as dark shades, but the more fugitive the tone or delicate the texture the weaker should be the solution. For black silks or satins which have become greasy during wear, the ammoniated liquid will be more effective when applied hot or moderately heated.

Producing Fire and Smoke for Theatrical Performance.—For producing the effect of fire and smoke at an amateur theatrical performance ordinary coloured fires could be used only where the stage is ventilated. For an ordinary room, the best results would be obtained by throwing on to a red-hot plate a mixture of lycopodium powder and ammonium chloride. The lycopodium yields an immense flame, and the ammonium chloride produces a great fume. Care must be taken that nothing inflammable is near, or the result would be disastrous.

Glaze for Light Oak Graining.—For making 1 pt. of glaze for darkening light oak graining, mix together 2 oz. blue black and 1 oz. burnt Turkey umber ground in water. Thin down to form a wash with equal parts of stale beer and water; apply with a hog-hair overgrainer and soften or tone down with a badger-hair softener. Allow sufficient time to dry and then apply one or two coats of hard oak varnish. Two coats of glaze may be necessary, according to the depth of colour required.

Lathe Chucks for Pipe- and Stick-makers.—Figs. 1 and 3 in the accompanying drawings show, one-third full size, two common pipe chucks made in beech. The block is first turned approximately to the outline shown in Fig. 1; the pin is then screwed to fit the lathe

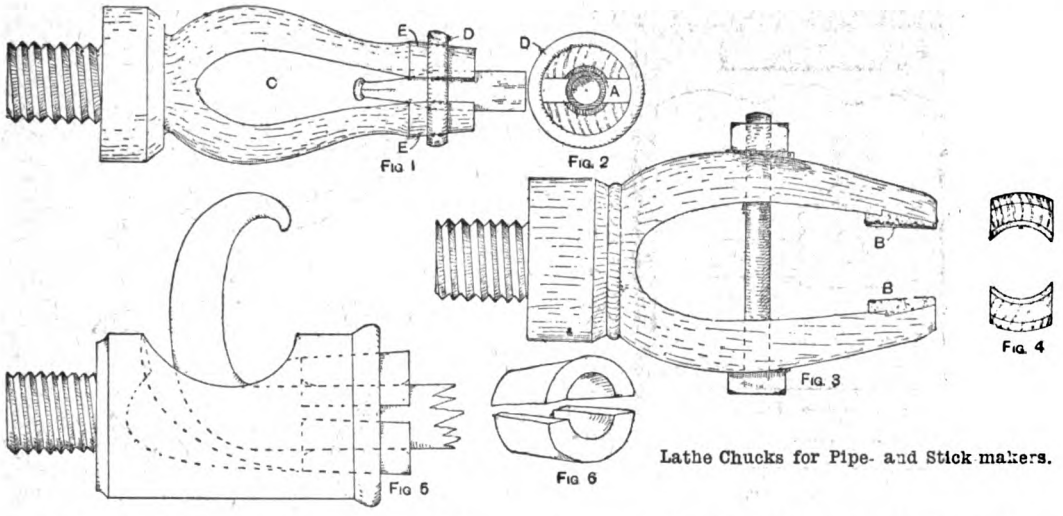


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6

Lathe Chucks for Pipe- and Stick-makers.

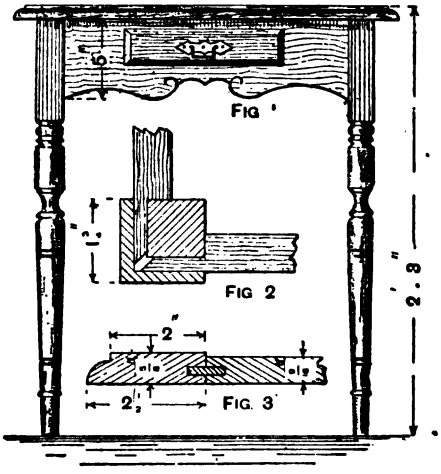
mandril, which is generally of brass with an internal thread. The chuck is then re-turned and bored out to the size required, plus the thickness of two pieces of rubber or cork, which are shown at A (Fig. 2) and B (Fig. 3), and which grip the job. The opening C (Fig. 1) is then cut out, thus dividing the chuck into two parts, connected together at the base, but each capable of a small amount of spring at the point. To fasten any object in the chuck the iron ring D (Figs. 1 and 2) is tapped up farther on the sloping part E. The chuck shown by Fig. 3 is made in the same manner, and is intended for bowls of pipes and larger objects than can be inserted in Fig. 1. It is closed by the nut and bolt, and Fig. 4 shows its end. The peculiarly shaped chuck shown in Fig. 5 is made in iron, and though sometimes found useful by a pipe-maker is more properly a stick-maker's and mounter's requisite. The inside is cored out to one or the other of the dotted lines and the stick is held by the two wedges (Fig. 6), of which there should be several sizes. These wedges are slipped in the front of the tool; see Fig. 5.

Setting Saw Teeth.—Below are instructions on setting the teeth of rip, hand cross cut, tenon, mitre, and panel saws. The teeth in a rip saw should be so filed that their fronts will be perfectly upright. A transverse bevel of from 3° to 5° should be given to the faces of the teeth. To give a bevel of 5°, the file should be held at angles of 85° and 95° respectively. The work of the hand cross-cut saw is to cut across the fibres of the timber, therefore the cutting edge must be keener than for the rip saw; otherwise the teeth will compress the fibres, so that difficulty will be experienced in making a cut. The fronts of the teeth in this saw should recline about 10°, and the file should be shot across the faces of the teeth at angles of 60° and 120° respectively. The chief work of the tenon saw is to cut the shoulders of the tenon (across the grain), therefore the sharpening is much the same as in the hand saw, the transverse bevel being a little less acute. The work of the mitre saw is to cut obliquely to the grain of the wood. The fronts of these teeth, therefore, should recline about 5°, and the file should be so held as to give a transverse bevel of from 10° to 15°, which will be at angles of about 75° and 105° respectively. The teeth of the panel saw should be sharpened much the same as the teeth of the mitre saw, as the panel saw is used for both ripping and cross-cutting. Tenons are cut in with this saw, after which the tenon saw cuts down the shoulder of the tenon. When setting saw teeth, care should be taken to get the set uniform; an equal amount of set must also be given to the teeth on each side or range. A properly ground ripping saw requires but little set. As hand saws vary in thickness, etc., the amount of set in each case cannot be definitely given. The hand cross-cut saw requires more set than the rip saw. The amount of set depends on the nature of the timber to be sawn, the thickness of the saw blade, how it is ground, etc. A saw thinner at the point than at the heel and thicker on the tooth edge than on the back edge will require less set than a saw of the same gauge throughout the blade, and a thin saw will require less set than a thick saw. The blade of the tenon saw being thin, and the cuts made with it not very deep, much less set is required in this saw than in the hand cross-cut saw. Very little set is required in the mitre saw; in fact, if the teeth are kept fairly sharp, the set required will be scarcely perceptible. The set given to panel-saw teeth should be a medium between that of the rip-saw teeth and the teeth in a properly ground hand cross-cut saw. Excessive set in each case should be avoided, as a saw will do its work better and more easily with only just enough set to free the blade. Set the teeth in each case with a small hammer.

Petroleum Furnaces.—There are two ways of burning petroleum for heating furnaces. In one, petroleum is supplied from a tank connected to the jet in front of the furnace by a small pipe; in the mouth of the furnace is a jet or atomiser, shaped somewhat like the tuyère of a blast furnace, through which a blast of air is blown in sufficient force to raise the petroleum into the jet, from whence it is immediately blown into the furnace by the blast. The furnace is first brought to a bright red heat by a fire, and the petroleum is then blown in as above described; it is immediately and perfectly burnt, producing an intense heat. In the other method the petroleum is placed in a tank above the furnace, and falls by gravity through a small pipe on to a large fireclay slab at the mouth of the furnace. The furnace is in this case also first brought to a red heat, and the petroleum is allowed to drip as fast as necessary from the pipe on to the red-hot tile. The sizes of pipes, etc., for the furnaces would have to be worked out by a person specially experienced in this class of work, or else found out by trial. No method which involves raising the whole of the oil to a boiling temperature is practicable on a large scale owing to the risk of explosion.

Black for Bolts and Nuts.—For a black for bolts and nuts thoroughly mix together one part of bismuth chloride, two parts of mercury bichloride, one part of copper chloride, six parts of hydrochloric acid, five parts of alcohol, and fifty parts of water. The articles to be blacked must be first freed from grease; this is best done by boiling them in a solution of caustic soda and drying in sawdust. When clean, dip them in the above solution and allow to dry, then place them in boiling water and boil for half an hour. If the articles are not then black enough, re-dip and re-boil. When they are of the correct colour, place them in a bath of boiling oil for a few moments, then heat them till the oil is driven off. An alternative method, and one that is frequently used for bolts, etc., is as follows. Dip the articles in oil, preferably linseed, and heat till the oil is burned off. The surface produced is coal black in colour, and will withstand almost any heat.

Card Table.—A card table 3ft. square is much too large; 2ft. square will be quite sufficient. Fig. 1 shows a design in elevation of a card table of the size last mentioned. The table should be made of hardwood; if pine or whitewood is used, increase the thickness of the members about ¼in. Fig. 2 shows the method of joining the rails to th leg mortises. The framework is 1 ft. 8in.

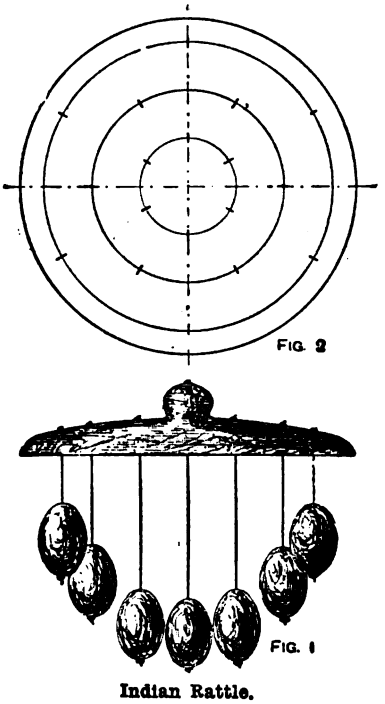


Card Table.

square, which will allow the top an overlap of 2in. all round. The drawer has a bevelled front which acts as a stop, and may be 10in. long by 5in. wide. Two methods can be adopted for making the top. The margin can be framed level with the centre with a suitable moulding worked on the solid or stuck on, the baize or leather centre can be laid, and the margin levelled with sawn veneer; or the centre can be left $\frac{1}{16}$in. lower on the top side, which will be filled up with the baize (see Fig. 3). In laying the cloth or leather, use equal parts of glue and flour paste; allow it to get nearly cold before using, and spread it on with a palette knife, sleeking out with a piece of smooth round-edged wood or a rubber roller squeegee. Knife the edges with a very sharp thin knife.

White Enamel Paints.—For enamel paints, use genuine zinc white and varnish; for outside work the palest and most durable varnishes, as French oil, carriage, maple, dial, and pale copal varnishes, pale gold size and turpentine being used as drying agents, whilst the enamels for interior decoration, not being subjected to the same atmospheric influences, may be prepared from mixtures of less expensive varnishes, as dammar or crystal paper varnish hardened with a little copal or French oil varnish. To prepare a durable enamel for outside use procure 10lb. of genuine zinc white in varnish, which must be ground exceedingly fine, 7 pt. of pale copal varnish, 1 pt. of pale japan gold size, and ½ pt. of American turpentine. Break up the zinc white and mix to a uniform consistency with a copal varnish, then add the gold size, and finally thin down with the turpentine, when it will be ready for use. Enamel for interior decoration may be prepared by mixing together as above 10lb. of zinc white ground in varnish, 4 pt. of dammar or crystal paper varnish, 3 pt. of French oil varnish, 1 pt. of pale gold size, and ½ pt. of American turpentine. In each case, should the enamel become thick, thin down with more turpentine. To prepare white enamel successfully always procure the palest and most durable varnishes. When applying enamel the undercoats should be perfectly solid and free from inequalities, otherwise the resulting work will appear irregular and patchy. The best methods of preparing the undercoats is to apply two coats of zinc white or white-lead ground in turpentine, adding a little oil to bind it, and flatting down each coat until a solid foundation is obtained, which will give the enamelled work a pure white appearance when finished.

Indian Rattle.—The following describes how to make an Indian rattle for amusing a baby. Hindoo mothers hang one up for their child to kick at, and when the rattle is shaken, the egg-shaped balls bob about and the noise is like the clucking of a hen to her chicks. A piece of hard wood 1½in. thick is turned to a shape like that of the cover of an old-fashioned earthenware jar and 7in. in



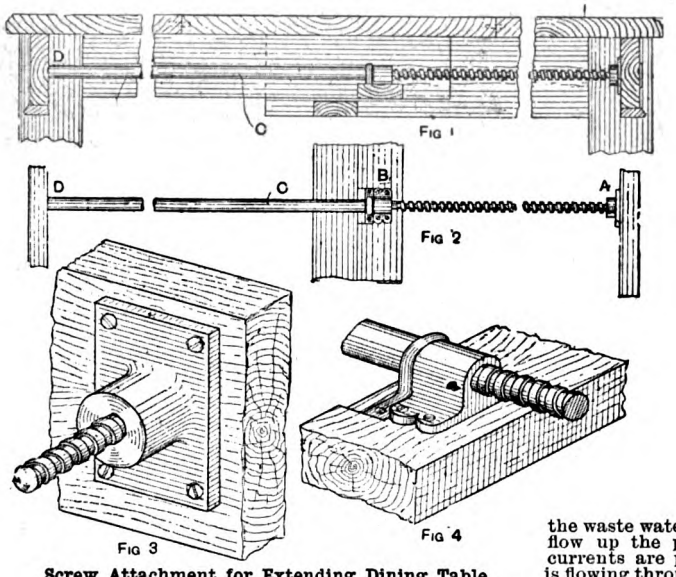
Indian Rattle.

diameter; see Fig. 1. Take the wood off the lathe, and on the flat side mark circles with radii of 1in., 2in., and 3in. respectively. Then step round these circles with their own radii, marking them off as shown in Fig. 2. Now turn up nineteen egg-shaped pieces about 1½in. by 1in., and bore holes through their lengths for elastic cords. Take one egg, thread it on and knot the elastic, and cut off 6in. of it, putting it through the centre of the disc and fastening. Cut six lengths of 5in., threadle the eggs, and put them on the small circle, and proceed similarly with the next six eggs, making the elastic for those 4in. long, another six being kept 3in. long. When in position the eggs form a sort of inverted cone. A cord is fastened to the top, and the whole is suspended over the cot so that the baby can kick it. The addition of a toy bell to each cord would make it more musical, but would not be strictly Indian in character. Rattles made in India are generally painted in brilliant colours such as vermilion, with yellow lines on the eggs.

Welding Channel Tyres.—To weld channel tyres properly a special forge is required. Such a forge is described and illustrated on p. 169, Series II. Of course, for different shaped channels, top and bottom tools to match would be necessary. In the absence of such a forge it is possible to use an ordinary forge by simply flattening out the ends of the tyre bar and then welding up in the usual way, working the flanges back to shape again by using top and bottom tools as described in the reply referred to above. For welding, flux is not necessary, a clean fire and some sharp white sand being found sufficient.

Heating Value of Range Boilers.—The effectiveness of range boilers in heating water depends upon the area and disposition of the heating surface. For a given position in relation to the fire the greater area has the greater general effectiveness, while the surface nearest to the incandescent fuel has greater effectiveness than the surface farther removed. A block boiler having say 1½ sq. ft. of heating surface would have about ¾ ft. in the fire, ½ ft. in the flue under the boiler, and ¼ ft. in the flue up the back. The relative effectiveness of these surfaces is about 10, 6, and 4; in other words, the front surface against the incandescent fuel is of double effectiveness to the average of the remainder. The surface of the tubular boiler is wholly of this best kind, and every foot of surface of the boiler is one-and-a-half times as effective as an average foot in a block boiler. The total effectiveness of a boiler therefore depends on the surface. If a block boiler could be provided with about double the heating surface possessed by a tubular boiler (which, however, is unlikely), the block boiler would be the more effective of the two. But the tubular boiler has in the boot boiler a more powerful competitor than the block boiler.

Screw Attachment for Extending Dining Table.—The accompanying illustrations show a screw attachment used for extending dining-room tables. Fig. 1 shows a part sectional view through the table and elevation of the screw arrangement; Fig. 2 is a plan. One end of the screw works in a collar as shown at A



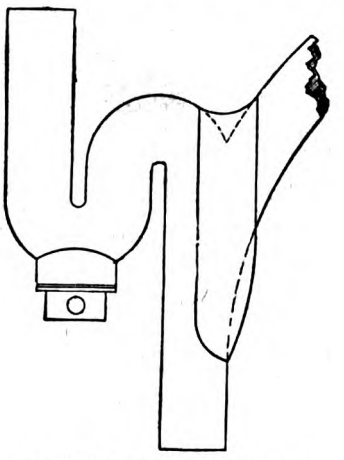
Screw Attachment for Extending Dining Table.

(Fig. 2), through which the screw projects, having a square end so that the handle can fit on it. At the other end of the screw is shown the box through which it works (see B, Fig. 2); C (Figs. 1 and 2) is the barrel, one end being attached to B; the other end D is sometimes let into the rail of the table as indicated. Enlarged conventional views of A and B are given at Figs. 3 and 4. The end D (Figs. 1 and 2) is let into the end rail. These screws can be obtained from any cabinet ironmonger.

Heating Building by Steam, Hot Air, or Hot Water.—Private residences are preferably heated by hot water, and even for huge business places, stores, buildings and the like, hot water is largely used, the fires being kept going night and day so that frost is defied. A hot-water apparatus is more easily regulated than any other, and the temperature of the rooms can be raised or lowered as desired. But hot-water work, when properly done, is the most expensive plant to instal, although the most economical in the end. Steam, on the other hand, is always at one temperature (in this work) and is objectionable to this extent, that for half the cold season, full heat is undesirable and unnecessary, and the consumption of fuel is greater than the weather requires. But steam plant is moderately cheap to erect, and compared with water is very quick in heating up. This is an advantage in places where the fire is not kept alight continuously; and, of course, steam pipes being empty of water when cold, frost can work no mischief. Heated air (heated by stoves, not hot water) is not used to any great extent. This mode of heating is moderately cheap, but many people do not like the hot air because of its occasional dryness. This largely depends on how the apparatus is erected and afterwards used. Air that is warmed by passing over heated iron is rendered disagreeably dry (1) if the iron attains a high temperature, and (2) if water pans to furnish the air with moisture are not provided. But when the apparatus is properly attended to, and the bad conditions referred to above are prevented, this mode of heating is not to be condemned. Perhaps the greatest drawback to heated air is the trouble caused by surveyors and fire-insurance agents, who do not look kindly on this mode of heating. Heated air does not possess advantages over hot water or steam as a heating agent.

Cleaning Copper Urn.—Rub the urn with a mixture of fine ground crocus powder and best sweet oil; use a brush for the ornamental portions. Polish off with a dolly used on a lathe and dry crocus powder.

Ventilation Pipe on Sink Trap.—The accompanying illustration shows the proper position of the ventilating pipe on a lead syphon trap under a sink, and also the manner of making the joint. Many men, whenever possible, fix the vent pipe on the crown of the trap. But this plan is very objectionable, because in a few weeks the pipe becomes choked. As shown in the illustration,



Ventilation Pipe on Sink Trap.

the waste water passes the end of the pipe but cannot flow up the pipe. Further, whichever way the air currents are passing (which is upwards when no water is flowing through the waste pipe, and downwards when the sink is being emptied) no sharp turns exist to retard the velocity of the flow of air.

Determining Lifting Power of Balloon.—The weight that the balloon will carry may be determined by experiment. Fill a small balloon with hydrogen gas, attach a light car to the balloon, and pour shot into the car until the balloon will only just rise from the ground. Weigh the balloon and car when empty, together with the shot, or the shot alone if only the useful weight that the balloon will lift is required.

Imitation Mother-of-Pearl for Cycle Frames.—One method of producing imitation mother-of-pearl embellishments on cycles that are to have a stove enamel finish is as follows. The frame is given a coat of priming, stoved, and flatted down. The second coat is white; this is also stoved and flatted down. The blue and green tints are put on side by side, and drawn out with a dry camel-hair brush, leaving spaces of white, and again stoved. Cut up with black enamel into irregular squares, diamonds, dots, etc., and stove. Another method is to procure some scrap mother-of-pearl from a pearl button factory. Give the frame a thick coat of enamel, stick the pearl scrap, which must be very small, on the enamel in any suitable shapes, and stove. Continue to coat and stove until the pearl is covered. Flat down with wet pumice powder until the pearl is level with the surface of the enamel. Give a coat of finishing enamel, flat down, and polish with dry rottenstone.

Rendering Gelatine Tough and Elastic.—To render gelatine tough and elastic, mix with it a material that will hold a certain portion of water, so that the gelatine does not become dry. Perhaps the best materials for this purpose are glycerine and treacle. The proportions to be used will have to be found by experiment, but the quantities given below will serve as guides. Take 1 lb. of glue or gelatine, add just sufficient water to cover it, allow to stand overnight, then melt down by a gentle heat and stir in ¾ lb. of glycerine, or 1 lb. of glue treated as above and ¼ lb. of treacle. In using these mixtures there is a drawback, from the fact that in a damp place they absorb moisture, and become sticky; to obviate this, add ¼ oz. of bichromate of potash. The bichromate of potash, under the influence of light, renders gelatine insoluble.

Inserting Wrest-pins and Hitch-pins in Piano.—When inserting pins in a piano, it is, of course, necessary that all the holes of a series should be bored at a certain angle; the holes in the wrest-plank are bored in such a way that the pins will incline slightly upwards, the holes in the bent side and bottom plate for hitch-pins incline downwards, and the holes for bridge-pins are bored at an angle that will best resist sideway strain. A carpenter's ordinary brace stock will be found very inconvenient for making the end holes. A drill stock

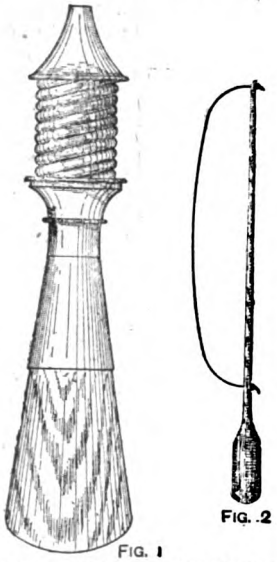


FIG. 1

FIG. 2

Drill Stock and Bow for Pianoforte Makers.

and drill bow (see Figs. 1 and 2) will be a much more convenient tool and less tiring to the worker; the whole series represents nearly one thousand holes. The holes for the wrest-pins are made with a good quality quill bit; its size must correspond with the pins that will be used. As the sizes of the pins vary, it is advisable to experiment on a spare bit of beech before boring the holes; all should be a true fit, and fairly tight. The quill bit should fit direct into the stock, and, to ensure the holes being bored of a uniform depth, the bit should be run through a piece of 1-in. dowel rod endwise, one end to butt against the stock, and the other end being cut so as to leave sufficient of the bit free for boring to the required depth. To enable drills to be used in the same stock it is furnished with extra iron pads or chucks; one end fits into the stock similarly to the quill bit, the other end being furnished with jaws to hold the bits; these are secured by a set-screw. The drill bow is of lance wood 2 ft. 9 in. long, ¾ in. wide at one end, ½ in. at the tip, and ¼ in. thick; 6 in. of the wider end has an extra thickness planted on each side, and is then shaped into handle form. At ¾ in. from the handle and tip, holes are bored through which to pass a length of gut as used on violoncellos; the ends of the gut are secured by tying into knots. The gut should be sufficiently long to enable it to be passed round the grooved part of the stock once and bend the bow sufficient to give clearance as it is worked to and fro. Drill bows can be bought made of iron, and are extremely useful for the smaller holes, but are apt to strain the wrist if used for the larger holes. Holes for the insertion of screws or bolts in wrest-planks are bored by a carpenter's ordinary long twist bit. For screws, two bits of different size should be used, the larger bit to bore the hole half the depth, the other bit not quite the depth of the screw; this will enable the screw to gain a firmer grip. The holes should be countersunk to allow the screw heads to fit in level with the face of the planks, unless mushroom-head screws are used with brass collars; in this case, countersunk holes are not required; the screws are turned home with a screwdriver bit fitted into a brace stock. If bolts are used, the holes are bored right through; in either case, care should be taken that the screws or bolts are so placed that they pass through or grip into the bracings.

Setting out Tennis Court.—A tennis court for the single-handed game (one player against one) is shown in Fig. 1; whilst a tennis court for the three- or four-handed game is shown in Fig. 2. For the single-handed game the court is 27 ft. wide and 78 ft. long, and is divided across the middle by a net, the ends of which are attached to the tops of posts A A (see Fig. 1), which stand 3 ft. outside the court on each side; the height of the net is 3 ft. 6 in. at the posts and 3 ft. at the centre. At each end of the court, parallel to the net, and at a distance of 39 ft. from it, are drawn the base lines C D E F, the extremities of which are connected by the side lines C E and D F. Half way between the side lines, and parallel to them, is drawn the half-court line G H,

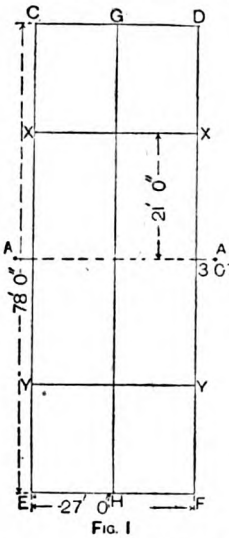


FIG. 1

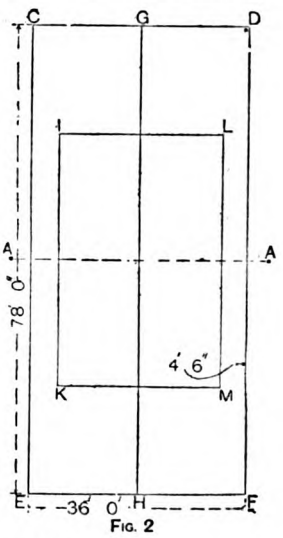


FIG. 2

Setting Out Tennis Court.

dividing the space on each side of the net into two equal parts called the right- and left-hand courts. On each side of the net, at a distance of 21 ft. from it and parallel to it, are drawn the service lines X X Y Y. In the three- or four-handed game the court is 36 ft. in width. Within the side lines, at a distance of 4½ ft. from them and parallel to them, are drawn the service lines I K and L M. The service lines are not drawn beyond the points I, L, K, and M towards the side lines. In other respects the court is similar to that for the single-handed game as illustrated by Fig. 1.

Position of Load Water-line in Boats, etc.—In boats the load water-line is not usually taken into account. In yachts and launches it is usually the line about which the profile is designed; then when the designer has determined roughly the weights of hull, stores, machinery, etc. etc., he decides on the amount of displacement that will be required. Experience teaches what lines upon given dimensions will give the best results. In a cargo ship it is precisely the same, only the quantity of cargo required has to be taken into account as well as the other weights. With an existing craft aground, to determine the probable load-line the calculations are somewhat complex; the shape of the craft has to be taken off, the displacement worked out to an approximate line, and the weight determined either by calculation or on the balance principle; then, as the displacement must agree with the weight of the craft and her equipment, so the approximate load-line is shifted until the displacement and weights coincide.

Removing Oil Stains from Book Cover.—It is considered rather a hopeless task to attempt to remove oil stains from a book cover, though the following method may be tried. Make up a pad of a few pieces of good blotting-paper. Lay this over the stain, and press on it a hot flat iron. Continue this treatment for some time, occasionally lifting the blotting-paper to examine the spot. Care must be taken that the heat from the iron does not injure the cover. Now make a small pad of cotton-wool, well soak it with benzine (procured from a chemist), and with this wash the entire cover, taking care not to rub or to apply the benzine in patches. Let the washing be done with broad, swift strokes from side to side of the cover, and from top to bottom. When washed, allow to dry thoroughly. When the benzine is applied, the cover will probably look black, or very much darker than it was originally, but this will pass away, and with it possibly the oil stain. When using benzine, keep it well away from artificial light or fire, as it is highly inflammable. Use it in a cool room in daylight. After the cover has become dry, it can be washed again and again.

Threading Curved-needle Sewing Machine.—Fig. 1 represents the moving arm of a curved-needle sewing machine. Place a reel of cotton (No. 40) on the spool wire at the rear of the machine, draw the cotton into the thread check A, around the tension pulley B in the direction indicated by the arrow, thence through the eyelet C to the hole D, and through the needle eye E

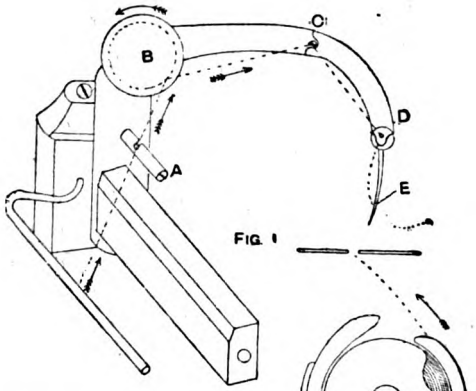


FIG. 1

Threading the Curved-needle Sewing Machine.

FIG. 2

from left to right. Fig. 2 shows the threading of the under cotton. Place a bobbin on the long winder spindle, and wind the bobbin fairly full of No. 40 or No. 50 cotton; then remove the ring slide, and place the bobbin into the cavity of the hook, allowing the cotton to draw from the rear toward the front, as indicated by the arrow. Bring up the ring slide as close as the stop-screw will allow, and tighten the set-screw. To begin sewing, raise the presser foot and place the goods to be stitched on the cloth-plate, drop the presser foot, hold the upper and lower threads in the right hand, and commence to sew by turning the cam wheel from the machinist.

Thermometer.—To make a thermometer, some knowledge of glass-blowing is needed. Presuming that the tube has been obtained, the following is the method adopted for excluding the air, filling with mercury, and sealing the end. The common mercurial thermometer consists of a glass tube of uniform bore, terminating in a hollow bulb. By holding the bulb over the flame of a spirit lamp, a considerable portion of air is expelled from the bulb and tube; and the open end of the tube being immersed in a cup of mercury, as the air within the tube and bulb condenses, the external atmospheric pressure drives a portion of mercury in to fill the space. A paper funnel is next tied round the open end of the tube and filled with mercury. Then the mercury already in the bulb is boiled over a spirit lamp, with the result that the whole of the air remaining in the tube is soon expelled and its place taken by mercurial vapour. The instrument being again allowed to cool, the mercurial vapour is presently condensed, and its place supplied by mercury driven down the funnel. The process is continued till both bulb and tube are completely filled with mercury. Lastly, when the mercury has cooled down nearly to the highest temperature intended to be measured by the instrument, the end of the tube, hitherto open, must be perfectly sealed by means of the blowpipe. As the mercury afterwards continues to cool, it will be considerably condensed, and, sinking down, will leave a vacuum in the upper part of the tube. The thermometer has now to be graduated, and for this purpose it must first be immersed in melted snow. When the mercury has sunk as low as it will go, a graduation must be marked opposite the extremity of the mercurial column for the freezing point. The thermometer is next immersed in the vapour of water, boiling under a given atmospheric pressure. When the mercury is again stationary another graduation must be marked opposite the extremity of the mercurial column for the boiling point. The distance between these two graduations is then divided into a number of equal parts, and divisions of the same extent are marked in both directions to the extremities of the tube. The instrument will then be completely graduated, and may be mounted in any way desired.

Spring Cushion.—To make a spring cushion, bend some ¾-in. round iron to the shape as shown Fig. 1; either lap the joints one over the other to preserve the correct outline, or have them welded. If desired, ½-in. cane can be used instead of the iron, but it is more difficult to work to the correct sweep. Two frames, one

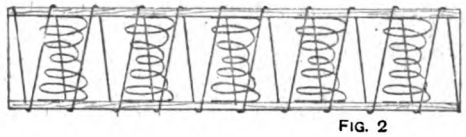


FIG. 2

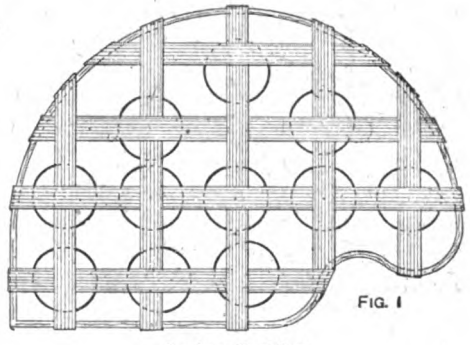


FIG. 1

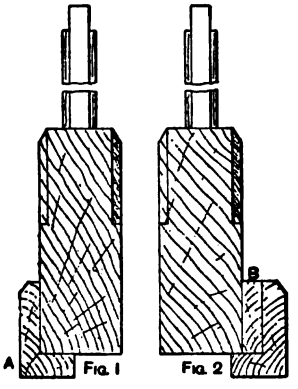
Spring Cushion.

each for top and bottom, will be required; cross-web these with good grey webbing, which must be lapped over the iron or cane, and sewn fast. Sew the springs to the webbing by the top and bottom coils. Press the two frames down until the springs are compressed about one-third their length; then lash the two frames together all round the edges with laid cord (see Fig. 2). Cover the top and borders with hessian, and stuff up on this. The covers will require welting and piping at the front at least, and any tufting can be tied up before the bottom is underlined with black Forfar, which is turned in at the edges and stitched fast. If the cushion is stuffed all round the borders, make the frames about 1 in. smaller than the finished size. For plain borders and stuffed front, net measurements will have to be taken; the slight swell at the front will be an advantage.

Purifying Bed Feathers.—Baking is only possible for chicken and turkey feathers. The feathers of all aquatic birds require other and more delicate treatment to get rid of the greasy impurities, and if used after merely baking may give off an unpleasant odour later. In the absence of proper purifying and teasing machinery the following method can be adopted. Make up a bath of 12 gal. of cold water, and in this dissolve 2 lb. of alum, 2 lb. of cream of tartar, and 1 lb. of washing soda. Place the feathers in this and allow to stand for three days, then wash them in clean water. Now make a bath of 3 oz. of chloride of lime and cold water. Place the feathers in this for a few hours, then rinse in clean water and dry on a wire grid. It would be an advantage to run the feathers through a willowing machine before again making them up.

Detecting Carbonic Acid in Atmosphere of Room.—A method by which the presence of carbonic acid gas in a room can be detected is the following. Fill a large wide-mouthed bottle (a pickle bottle for instance answers very well) with water, and carry the bottle of water into the room the air of which is to be examined. Invert the bottle so that the water may run out into a basin or bucket, and the bottle will then be filled with the air of the room. Now pour into the bottle a little clear lime-water, shake vigorously, and the lime-water will become turbid owing to the formation of carbonate of lime. A saucer filled with lime-water placed in the room would, in a short time, become covered with a pellicle of carbonate of lime. These results would be obtained with air taken from any situation, because carbonic acid is a normal constituent of the atmosphere, being present to the extent of 4 parts in 10,000; only when carbonic acid is present in excess does air become vitiated. In living rooms the carbonic acid may increase to 6 or even 8 parts per 10,000, but the rooms then feel stuffy. The comparison between a pure air and a vitiated air is found by a quantitative determination of the carbonic acid.

Converting Rebate Plane to Side Fillister Plane.—To convert an ordinary 1¼-in. rebate plane into a side fillister plane to make rebates of any width, all that is necessary is to box out a fence of hard wood, preferably birch, and screw it on the plane as shown at A (Fig. 1). If a left-hand plane is required, screw it on the other side as shown in Fig. 2, and to alter the



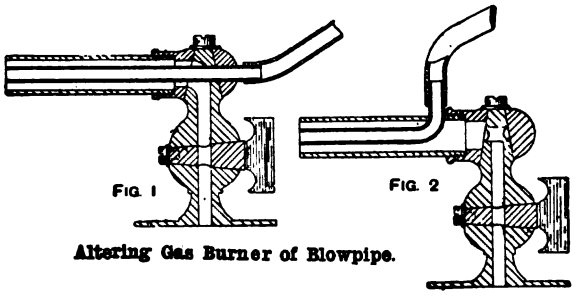
Converting Rebate Plane to Side Fillister Plane.

width of the rebate insert a strip of birch of the necessary width between the fence and the plane as shown at B.

Chippendale Furniture.—The name "Chippendale" is derived from Thomas Chippendale, a London cabinet-maker and wood carver, who in 1764 published designs for furniture. He professed to draw his inspiration from the then prevalent French fashion, but shows a greater tendency to follow architectural lines. The material used by him was almost invariably mahogany. The characteristics of this furniture are sound workmanship, elegance, and delicate carving. Perhaps mahogany chair backs, somewhat architectural in design, are the most typical Chippendale ordinarily to be met with. The strapwork mahogany chair backs, so frequently confounded with Chippendale, are rather to be attributed to the influence of Heppelwhite, whose designs for furniture were not published till 1789.

Resetting Wrest-plank of Piano.—Wrest-planks inserted in pianos are glued and tightly cramped into proper position before screws or bolts are put in. If both gluings and screws give way owing to the excessive strain of the wires, before the plank will return to its former position this strain must be released by slacking out the wires, and it is doubtful whether a really sound job will result from merely inserting bolts in place of the screws. The correct plan of procedure would be to slack out the wires and remove the top capping (a thin board glued on top of the plank); this will be destroyed by removal, and must afterwards be replaced. The defective joint thus exposed to view should be freed from old glue, chips, and shavings, and two wedges should next be driven in to open the joint at least ¼ in., and on each side of this joint, and extending the whole length of the instrument, two narrow slips of wood should be fixed by fine brads, to form a channel. Hot glue is run into the channel, and is then worked well into the joint by means of a table knife with a long thin blade, which has been warmed by dipping into hot water. A powerful cramp should be fixed at the middle of the plank, a block of wood being put against the face of the plank first. The wedges being removed, the cramp is tightened up, two extra wedges being placed on each side. All the wedges are tightened up, fetching out thereby as much glue as possible. Allow the piece to stand in the cramps at least twenty-four hours, and as these are removed, bore holes right through where the screws were formerly inserted, and put bolts through in their places with washers under the nuts. The slips forming the glue channel may now be removed, the surface levelled and freed from glue, and a new capping put on. The instrument will require to be tuned several times before the wires will settle to their normal position; at least three days should be allowed for the glue to harden before tuning is attempted.

Altering Gas Burner of Blowpipe.—If only a small blowpipe jet is required the supply of gas might be much restricted by reducing the size of the swivelling pipe of the blowpipe to about one-half its present diameter. If, however, a good sized blowpipe flame is required, the better plan would be to tighten up the screw on top of the swing joint so that it could not move, and to drill a hole right through it from the back, and this could be tapped. A smaller pipe screwed one end could be inserted from the free end of the larger pipe and screwed into the tapped hole; the two concentric pipes should then be cut off to the same length (see Fig. 1). Care must be taken that the gas can get to the outside of the inner pipe. A rubber tube affixed to the back end of the inner pipe can be used to blow



Altering Gas Burner of Blowpipe.

through, when an excellent flame will be obtained. If the fitting is preferred to swivel as at present a pipe could be inserted as shown in Fig. 2, and this would have the same effect. It should be remembered that gas requires for its complete combustion five and a half times its volume of air, and in ordinary Bunsen or atmospheric burners the quantity of air supplied through the side holes should be 2·3 times the volume of the gas, the remaining 3·2 volumes being supplied by the air around the flame. In the blowpipe nearly the whole 5·5 volumes of air are supplied by the blowing.

Incense.—The ingredients for incense vary with the makers, but the following may be taken as examples. (*a*) Powdered sandal wood 4 lb., powdered cascarilla bark 2 lb., gum benzoin 2 lb., vitivert ½ lb., nitre ½ lb., and musk 1 gr. Mix the ingredients thoroughly. (*b*) Wood charcoal 2 lb., gum benzoin 1½ lb., vanilla, tolu balsam, and cloves ½ lb. of each, sandal wood oil ½ oz., neroli oil ½ oz., and nitre 3 oz. Powder the solid ingredients and mix well.

Effect of Temperature on Length of Tie-rod.—The range of temperature in England between the extremes of summer and winter may be looked upon as causing a variation of ¼ in. per 100 ft. in the length of an exposed iron rod, bar, or girder. Therefore a tie-rod 40 ft. long hidden in the floors of the interior of a building would vary considerably less than two-tenths of an inch, probably not more than one-tenth, and if tightened up in the summer the tendency to contract in the winter would be taken up by a slightly increased tensile stress in the rod, so that no movement of the walls need take place. In the case of a flank wall, where tie-rods cannot be carried through the opposite party wall, the rods may sometimes be carried diagonally to front and back wall respectively, near the junction with the party wall. The end of a tie-rod should be jumped-up by the smith so that a larger thread may be put on, a 1-in. rod with a 1¼-in. screwed end will be increased in strength 40 per cent. over a 1-in rod with a 1-in. screwed end, because the full diameter of the rod will be utilised.

Mixing Beeswax with Liquid Starch. — Perhaps the best way of incorporating beeswax alone with liquid starch is to prepare a very stiff paste by mixing 1 part of dry starch with 5 parts of water and boiling while stirring. The beeswax should be melted in a separate pan and poured very slowly into the paste while it is being stirred vigorously. The stirring should be continued until the mass is nearly cold in order to prevent the beeswax separating in lumps and keep it as an emulsion in the starch. The starch may afterwards be mixed with warm water, but the temperature should not be allowed to rise above 140° F. or the beeswax will melt and come to the surface. An emulsion of beeswax could be made by using pearlash, but this might possibly injure the size. Beeswax is not easy to incorporate in this way, hence japan wax and paraffin are used.

Trousers Press.—The drawings show a trousers press 2 ft. 6 in. long by 1 ft. wide. When tightening up some of these presses, more pressure is sometimes brought to bear on the outside than on the inside; this can be obviated by tapering the ledges towards each end, thus leaving them thicker in the middle and curved on their side next to the board, as shown at Fig. 2. For making the press, hardwood is to be preferred, but pine may be used for the boards, and mahogany, beech, oak, or any

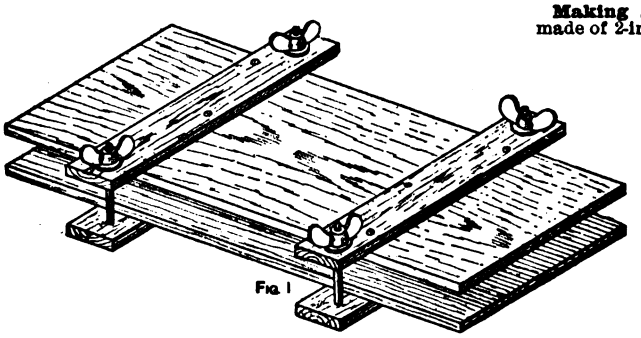


Fig. 1

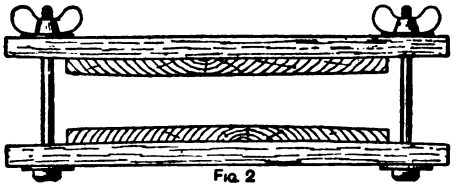


Fig. 2

Trousers Press.

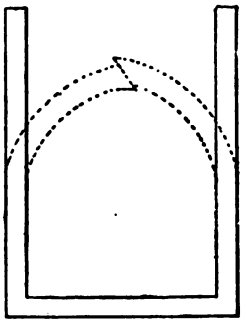
similar hardwood for the ledges. The boards should be ¾ in. thick, and the ledges ¾ in. in the middle, tapering to ½ in. at each end, and about 3 in. wide. It will be advisable to screw the boards and ledges together. For the tightening arrangement, bolts about 4 in. long by ¼ in. to ⅜ in. in diameter, with wing nuts, should be used, a good plan being to have washers next to the head of the bolts and under the nuts. To prevent the washers under the nuts becoming lost, they should be countersunk and secured by a couple of screws to the ledge.

Petroleum Jelly.—To make petroleum jelly melt 1 part of paraffin wax in a pan, and stir in 5 parts of a heavy mineral lubricating oil. Stirring should be continued till the mass is nearly cold. Ordinary petroleum jelly is made from yellow wax and oil, but a white kind may be obtained from white wax and a very pale-coloured oil.

Painting Ceiling in Flatted Oil.—For painting a distempered and cracked ceiling in flatted oil, first wash off the old distemper, and remove and make good any loose parts. Repair the cracks with plaster or Keene's cement, and cover the ceiling with lining paper, care being taken to make the paper good at the joints without lapping, or the edges will show. The ceiling should be sized previous to putting on the paper, which, when up, should also be sized. When thoroughly dry give two coats of paint mixed with a little more oil in it than turpentine (such as is used for priming new wood), which should be tinted to the tone that it is intended to finish the ceiling. For the second coat a little more turpentine might be added to the paint. If after the second coat the ceiling looks patchy—that is, dead in some places and glossy in others—apply a third coat of paint. When the colour is dry, but not too hard, mix up the flatting (white-lead broken up in turpentine) with a little oil to bind it and keep it open for working. The flatting should be either a little lighter or deeper than the oil ground, for as the flatting when wet has the same gloss as the colour on the ceiling, it is difficult to see whether the work is all covered. The edges of the flatting must not be allowed to set, or the ceiling will look streaky and glossy in places. As the colour is put on it must be stippled over with a dry brush or a stippler, to get the surface uniform. Work with the scaffold across the light and not in the direction of the light entering the room.

Carbolic Floor Varnish.—The following is a simple sanitary floor varnish and stain combined. Dissolve 2 lb. of orange shellac and 3 lb. of gum sandarach in 1 gal. of methylated spirit by agitating at intervals, afterwards well stirring into it a few drops of carbolic acid. This varnish may be applied colourless, or coloured by adding, in variable proportions, vandyke brown and oak stain for light and dark oak, walnut, etc. For mahogany, add bismarck brown. Other colours may be prepared by adding aniline dyes, soluble in spirit. Apply the varnish quickly and evenly, two coats being necessary. It dries hard, with an excellent gloss, in a few minutes, and is an excellent disinfectant.

Making Square Iron Boxes.—For a box, which is made of 2-in. by ¼-in. section iron to an inside measure-



Making Square Iron Boxes.

ment of 4 in. square, take an 18¼-in. length of iron; if the measure is 4 in. square outside, cut off the plate 17 in. long. For a box 5½ in. square inside, made of 3-in. by ¼-in. stuff, cut off the iron 24 in. long; if 5¼ in. square outside, cut off 23 in. When making the boxes, first thicken the ends by jumping up, then form the two bottom corners as in the illustration, scarf the ends, bend them over, as shown by dotted lines, and weld up on the beak iron; then form the other corners by working up on a mandril of the size of the inside measurement.

Painting on Keene's Cement.—Keene's cement should not be left more than twenty-four hours before being painted, though twelve hours is better. Either water from the atmosphere condenses on the surface of the cement, or water from the atmosphere is absorbed by the surface layer of the cement, or water comes to the surface from the inner layers of material, with the result that the paint runs.

Covering Draught Screen.—Flax sheeting for covering a draught screen should be thoroughly wetted with cold water and stretched tight and even on the frames. Always commence tacking in the centre and work to the corners, the tacks being afterwards hidden with a coloured gimp or leather banding with brass studs. The sheeting could be primed and painted in oils or distemper, or appliqué ornaments of compressed pulp, carton-pierre, or gesso work, could be glued on and afterwards gilded or coloured. Flax sheeting can be purchased 31 in., 36 in., and 54 in. wide. American leather is also a good material for covering screens, being washable and durable, but it should be warmed before a fire before laying to prevent cracking. It allows the leather to expand a little, and the subsequent contraction on cooling makes a tight job. Japanese leather paper, Lincrusta Walton, printed sateens, silks, etc., are all suitable screen coverings. No advantage would be gained by using three-ply wood panels, except in the very thinnest stuff. The panels would look well if fretted and backed with soft fabric. In order to make the frame harmonise with the panels the stiles should be decorated with chamfers or beaded, with a fretted pediment to match and turned finials.

Bleaching Horsehair.—If white horsehair is required, the whitest obtainable should be chosen and bleached. First it should be thoroughly washed in hot soap and water, then passed through hot clean water and allowed to soak overnight in a bath of hydrogen peroxide rendered alkaline by ammonia; it should then be again put through clean water and slowly dried. Yellow and grey hair may be bleached in the same way, but they will not give a dead white.

Breeding Cage for Canaries.—Figs. 1 and 2 are front and side elevations respectively of a double breeding cage 3ft. long and 1ft. 8in. high. The wirework fronts are omitted, as it is preferable to buy these ready made. The cage is divided in the centre by a partition that may be made to slide in from the back. Mahogany, walnut, or oak may be used for the woodwork forming the front and outer portions of the cage. Fig. 3 shows

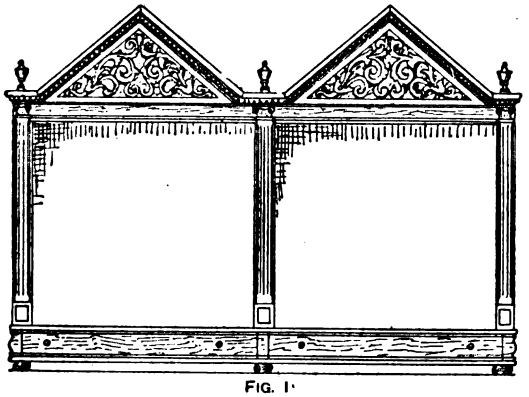


FIG. 1.

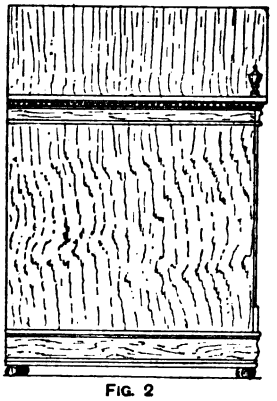


FIG. 2

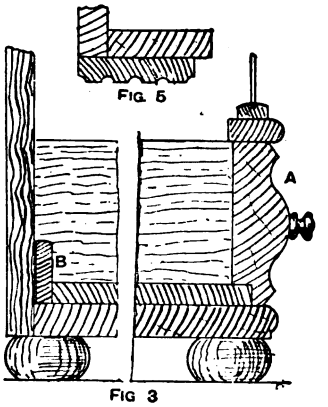


FIG 3

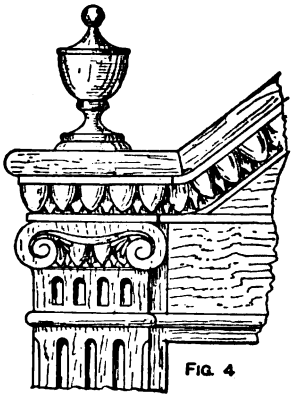


FIG. 4

Breeding Cage for Canaries.

an enlarged section through the drawer at the bottom of the cage. The front is moulded as at A, and the back of the drawer is shown at B. Fig. 4 is an enlarged detail of one of the pilasters, with a portion of the top moulding. The ovolo moulding, with the egg-and-tongue enrichment, may be bought ready prepared, either in pressed or machine carved wood. Fig. 5 gives a sectional plan through the pilaster. The pediments over the centre of both divisions of the cage may be filled in with fretwork, as shown in Fig. 1, or may be carved.

Building Small Punt.—Below are instructions on building a small punt in which cheapness, lightness, and very little draught are the three main requirements. For the sides, get two 1-in. planks 1ft. 4in. wide and 14ft. long; for the ends use 1½-in. planks. Cut the stern-piece 2ft. 6in. long at the bottom and 3ft. 4in. at the top. Cut the bow-piece 1ft. long at the bottom and 1ft. 8in. at the top, then cut a centre-piece 1ft. wide, 3ft. 4in. long at the bottom, and 4ft. 2in. long at the top. Put these pieces in position, and nail the sides to them. This can be readily done by bringing the planks into place with a rope across them twisted by a lever. After the sides are seamed, true up the bottom edges, and plank crosswise with ¾-in. planking, slightly bevelling the edges to allow for caulking the seams. The seams should be caulked with cotton or oakum and well coated with pitch; the sides should be similarly treated for about 3in. up. A piece of wood, about 1½ in. by 1in., nailed along the centre line to form a keel will prevent the bottom planking getting chafed. Seats can be fitted.

Painting Interior of Vapour Bath.—Paint for the inside of a vapour bath should be non-poisonous and should dry extremely hard. First apply two coats made by mixing 3lb. of zinc white ground in oil with equal quantities of turpentine and boiled oil, adding a little gold size as a drier. Allow the first coat to dry thoroughly before applying the second, then give a finishing coat made by mixing together 5lb. of zinc white ground in turps with 2 pt. of the best carriage varnish and ½ pt. of japan gold size. Allow seven days for hardening before using the bath. The above preparation will dry hard with an enamel surface and remain unaffected by the steam. Zinc white is non-poisonous.

Lime Concrete Floor.—Assuming that the floor is to be laid on earth, the cinders should be riddled through an ¼-in. mesh, throwing away all the fine dust that passes through the sieve. The lime should be blue lias lime, ground fine, and unslaked; the lime can be purchased in bags from the makers, like Portland cement, and the most suitable lime is obtained from Barrow-on-Soar, Rugby, and Lyme Regis. Pure or fat lime is unsuitable. Clean sharp sand, free from all earthy matter, will also be required. Prepare gauge boxes for measuring the materials, then on a wooden mixing-floor make a heap of four measures of cinders, one measure of sand, and one measure of lime. Turn the heap over twice with a spade to ensure a thorough mixing of the ingredients. Now make a cavity in the middle of the heap and add water from a rose, not from a bucket, turning the heap over from the edges into the middle. When the materials are all thoroughly wetted, but not sloppy, turn them over a second time and the concrete is ready for spreading. As the concrete is laid it should be well beaten down with a flat-faced punner. About 20 gal. of water will be required for each cubic yard of concrete. Before starting the work wooden pegs may be driven into the ground to indicate the correct level of the floor. The surface should be finished with a fine skin of Portland cement and sand, or should be tiled.

Drab Distemper for Walls.—For drab distemper for walls, melt 2lb. of Scotch glue in 1 qt. of water. In another vessel mix 14lb. of powdered Paris white to a thick paste with cold water, and add sufficient dry umber and a little yellow ochre to form a drab of the desired shade. Now stir the glue into the colouring matter and allow it to cool down, then add sufficient cold water until the required consistency is obtained, when the distemper is ready for use. Another method is to mix together 1lb. of common dextrin, 2oz. of alum, 10lb. of Paris white, ¼lb. of dry umber, and 2oz. of yellow ochre. Pass all through a fine sieve, and mix well together. To prepare for use, add sufficient cold water to form a paste. Both the above recipes are easy to prepare, and will not rub or peel off when dry.

Miniature Torches.—Miniature torches are made by wrapping round an ordinary tallow candle a piece of stiff paper rendered non-inflammable by dipping in a strong solution of borax or alum and drying; the paper does not burn, but serves as a support to the melted tallow.

Staining and Varnishing Rustic Work.—Here are brief instructions on staining and varnishing a summer-house that is built of oak and weather board. Stain both woods a dark oak by means of a water stain. To prepare the water stain, procure ¼ lb. of raw sienna and ¼ lb. of burnt Turkey umber, ground in water, and thin down to the proper consistency with ¼ pt. of liquid ammonia and ¼ gal. of cold water. Apply with a brush in the ordinary way; two coats will be necessary for the white wood. Allow to dry, then give a coat of glue size and again allow to dry, finally finishing off with two coats of hard outside oak varnish.

Open or Covered Reservoir for Storing Water.—Fig. 1 shows an uncovered reservoir (with dimensions) capable of containing 12,000 gal.; this reservoir is suitable for the storage of water intended for manufacturing and irrigation purposes only. Water for domestic use should be stored in a covered reservoir; a suitable roof for Fig. 1 is shown in Fig. 2. On the top of a covered reservoir 1 ft. to 2 ft. of earth should be placed, in order to keep the water cool, and ventilators should be placed in the corners of the arches. The walls and bottom of the reservoir are built in concrete, and the inner surface is rendered with cement, which should be brought to a perfectly smooth surface with the trowel. The usual accessories are the inlet and outlet, the overflow, and wash-out pipes. The inlet may be fixed on the most convenient side, about halfway up the wall, and so

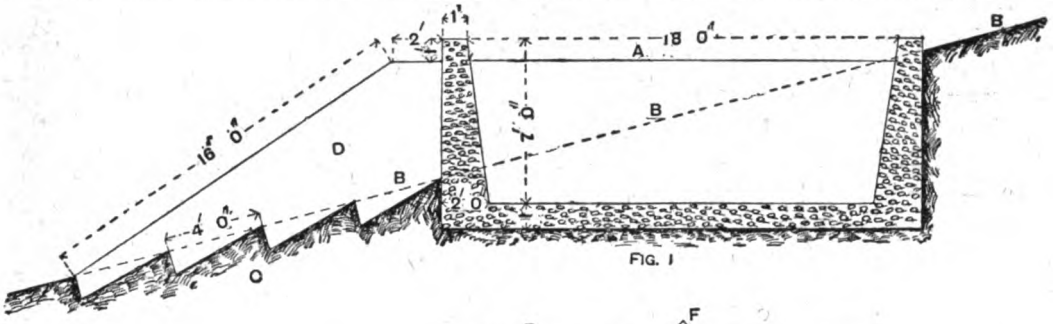


FIG. 1

Open or Covered Reservoir.

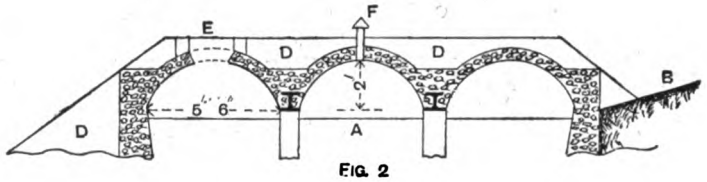


FIG. 2

arranged that the inflowing water may be shut off or diverted from the reservoir when it is being repaired or washed out. The outlet should be placed a few inches above the level of the floor, in order to allow any sediment to remain undisturbed. The mouth of the outlet should be covered with a tinned copper strainer. The supply is sometimes taken by a floating pipe which permits the water to be drawn from a little below the surface, the clearest portion of the water in a reservoir being near the surface. The outlet should be controlled by a sluice-valve fixed under the reservoir and worked from above by a wheel and spindle. The overflow consists of a vertical pipe (with an outlet at the base) carried up from the floor of the reservoir, having a bell-mouth for receiving the overflow; the inlet at the base is controlled by a valve that acts as a wash-out pipe. The mouth of the wash-out pipe should be situated at the lowest point of the floor of the reservoir, which should slightly slope towards the pipe. The letter references are: A water level, B surface of ground with 30° slope, C benchings, D earth, E manhole, F ventilator.

White Colour for Relief Stamping.—Possibly it has been found that in mixing whites with varnish for relief stamping the result is not satisfactory, the colour being very dirty, and not drying white. A good white colour for white stamping is made as follows. Boil some ground rice to a paste and mix with Chinese white (in tubes), thinning with water if necessary.

Photographic Formula for Iron Printing.—In order to obtain black lines on white ground in iron process, prepare solutions of (*a*) ferrous sulphate 20 gr., tartaric acid 20 gr., ferric chloride 20 gr., distilled water 1 oz.; (*b*) gelatine 40 gr., distilled water 1 oz. Soak the gelatine in cold water and dissolve by heat on a water bath; dissolve the salts and mix the two solutions. Coat the paper with a brush and dry quickly. Print until a yellow image appears, then transfer the paper to oxalic acid 15 gr., gallic acid 120 gr., water 40 oz. Pass through a bath of citric acid 1 in 80 and wash for half an hour. In order to obtain light blue lines on a paler blue ground, coat any well-sized paper with oxalic acid 1 part, ferric chloride 2 parts, water 10 parts. Develop in a 20-per-cent. solution of potassium ferrocyanide, wash well, immerse in 3-per-cent. hydrochloric acid, and rinse.

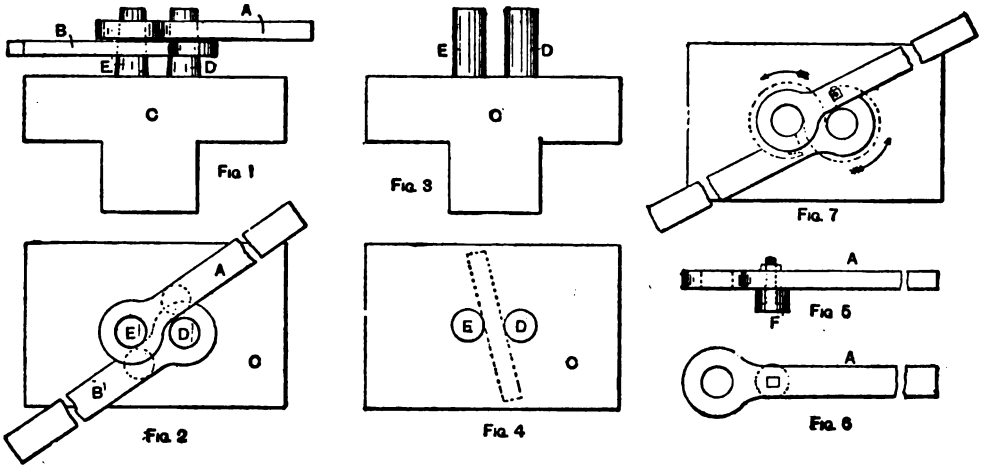
Restringing Tennis Racket.—For restringing a tennis racket, if the old strings are not available for use, procure new gut, though the old gut may be softened by steaming. If the strings have not been removed, careful note should be taken of the method adopted of working from vertical to horizontal, the starting point, whether single or double strings, and also that they overlap each other alternately. The tools required are a small hammer, a piece of ¾-in. round rod of hard wood, one end of which has been cut flat and a piece of cloth or leather glued on for use as a strainer, and a quantity of hardwood pegs about 2 in. long, tapered from ¼ in. at the point to a size that will just fit the holes already bored in the frame. Re-thread the new gut as originally done, secure one end by tying a knot, and pass through the opposite hole. Give a couple of turns around the rod strainer, putting the covered end on the frame, gently strain the gut till it has acquired the requisite tension, then drive in a peg. Continue the process till completed, and secure the points of overlapping by using coloured silk gut. When the ends are made secure, the pegs may be withdrawn, a piece of leather glued round the head, and the frame, which should have been previously cleansed with soap, salt and water, may be finished with white hard spirit varnish, applied with a camel-hair brush. The appearance will be smartened if the gut also is given a coat of varnish.

Preserving Brushes against Moths.—Proper ventilation has been found the cheapest and best preventive against moths. If the goods are stacked, move them occasionally, turning the pile and well shaking the bristles. Powdered camphor or wormwood sprinkled about the room, shallow saucers filled with ammonia or turpentine and replenished after evaporation, are all good preventives. For goods that can be dipped without impairing their appearance or value, make up a solution of ¼ lb. of alum, ¼ lb. of cream of tartar, and 1 gal. of water. Allow them to get thoroughly dry before stacking. Brushes are best tied in bundles with a paper cover round them and hung from the ceiling.

Polishing Turned Vulcanite.—To polish turned vulcanite finished with a scraping tool, take a handful of vulcanite shavings and apply these as the article revolves. Next prepare a piece of soft linen (a surgical bandage will do) by soaking in any sort of common oil, and sprinkle one side with putty powder (oxide of tin), then loop the prepared side round the article, holding the ends firmly with both hands, and work it evenly all over the article while the lathe is running, and finish the polishing in the same manner with a clean piece of linen without polishing medium.

Hair in Plastering.—Hair is used to make the lime and sand, or coarse stuff, hang together. The hair is obtained from the tanyard, and is usually specified as "long piled clean cowhair." The hair should be long, sound, and free from grease and dirt, and, if wet, should be dried. Before mixing with the mortar, the hair should be batted, beaten up, or switched with a lath until the matted portions are thoroughly separated. The usual plan is to put the hair on the plasterer's board, and the labourer, with a 2½-ft. lath in each hand, beats the hair until it is in a condition for use. The ordinary proportion is 1 lb. of hair to 2 cub. ft. of stuff for best work, and 1 lb. of hair to 3 cub. ft. of stuff for ordinary work. If the coarse stuff is hand-mixed, the hair may be added with the other ingredients at the first; if machine-mixed, the hair should not be added until just before the stuff leaves the machine. This precaution is necessary in order to prevent the hair being broken into short pieces and thus wasted.

Steel Wire S Hooks.—For making a quantity of steel wire S-hooks by hand, obtain a tool to the accompanying sketches. Figs. 1 and 2 show elevation and plan of the tool. The base C is made to fit either in the anvil or vice; E, D are the two stumps on which the hook is bent to shape, and A, B are the levers for bending the hooks round the stumps. Figs. 3 and 4 show elevation and plan of the tool. Figs. 5 and 6 show elevation and plan of the levers A and B; F is a small roller which revolves when bending the hook. To make the hooks, take a piece of wire of the length required, and place it between the stumps, as shown by the dotted lines (Fig. 4), then place the levers in position, and work both of them round together; the arrows in Fig. 7 show direction in which the levers are to move, and the dotted lines show the hook after the levers have been pulled round. All the parts of the tool should be made of steel, and the wearing parts should be hardened. Make the stumps E and D slightly tapering, so that the hooks will slip off easy after they are bent.



Bending Block for Steel Wire S-Hooks.

Sulphuretted Hydrogen.—To prepare sulphuretted hydrogen, act upon ferrous sulphide with dilute hydrochloric acid. Usually, it is made in a gas-generating bottle, which is an ordinary bottle with a wide mouth, having a cock fitted with a thistle funnel and a delivery tube. The gas is passed through a little water in a wash bottle to purify it, and then into water, or, if required as a gas, into dry wide-mouth bottles, from which it displaces the air. The hydrochloric acid used is the commercial acid diluted with three times its volume of water.

Rendering Tallow.—For rendering fats steam heating is almost universally adopted. By this the temperature can be better regulated than in any other way, and the whole mass in the pan is subjected to an equal heat. Fire rendering is only used for small quantities of fat, the expense of fitting up special plant not being justified, but this method does not produce such a white product as when steam is used. For rendering tallow with an open fire, the pan should be moderately shallow and set in brickwork in such a way that the sides as well as the bottom of the pan are heated. A hemispherical iron pan similar to a washing copper may be used, but should be supported either by an iron plate with a round opening to fit it, or else by a couple of bricks just over the firebars, leaving the remainder of the pan in contact with the hot gases from the fire; by fitting the pan in this way it would be much more regularly heated, and the tendency to burn the fat or membrane would be much less. In rendering, sometimes 1 or 2 per cent. of sulphuric acid is added, but such treatment necessitates subsequent washing of the fat and a second heating to remove the water. The fat is filtered by passing through canvas bags in a warm room; when done on the large scale the filter press is used.

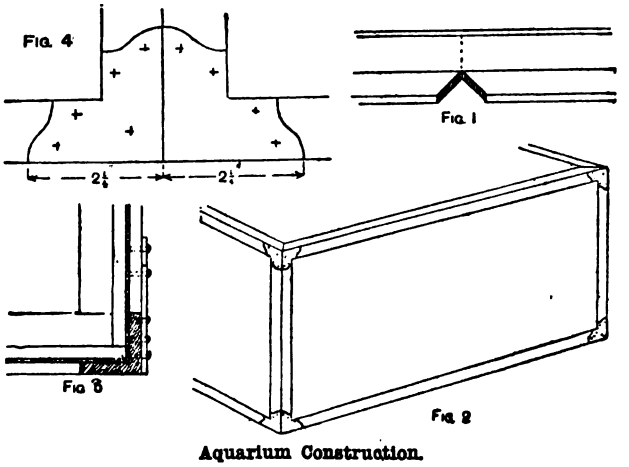
Cleaning Vellum.—This method, followed carefully, will restore dirty vellum to its original condition. Place the vellum on a board, and damp it well with a sponge, water being applied to both sides. The vellum will then get limp and will stretch. With the dressed side uppermost on the board drive tacks well in round the four edges, pulling the vellum outwards meanwhile as tightly as possible. Allow the vellum to dry naturally, when it will be found that all the creases have disappeared. To remove any obstinate dirt or stains, after the vellum has become dry, and while it is still tacked to the board, wash it with a weak solution of oxalic acid, say a pennyworth of acid dissolved in 1 pt. of water. It may be stated that in all skins of vellum there are transparent patches and certain natural marks, which, of course, will not be removed. Vellum must not be touched with glasspaper, as this would spoil it completely. If it is thin and is intended for a book cover, it should be lined with white paper. This is best done by again tacking it on the board with the undressed side uppermost, pasting the paper, placing it down, and rubbing it thoroughly, afterwards allowing it to dry in this position.

Preserving Eggs.—For preserving a quantity of eggs, add 1 pt. of unslaked lime to 1 gal. of water, boil, stirring it well, then pour it into a bucket and allow to cool, and the lime to settle at the bottom. Now fill some glazed earthenware jars with new-laid eggs, then pour on the clear lime water to cover the eggs, tie a piece of bladder or some non-porous material over the top of the jars, and store away in a cool place. This is an old-fashioned method, and it has the objection of making the shells brittle, and to some extent gives the eggs an unpleasant taste. Anything that will seal up the pores of the shells will preserve the eggs, and coating with white of egg, or painting with gum-water, or greasing, will keep them fresh for a time. At an exhibition in Birmingham, some eggs were shown that were preserved by rubbing with vaseline and packing in bran, and some were rubbed with lard and packed in peat mould. Water glass is now often used for preserving eggs. Water is boiled and allowed to cool, then one-tenth of its bulk of water glass is added, and this is used in a similar manner to that employed with the lime-water described above.

Removing Stains from Yorkshire Stone.—The removal of a brown stain from Yorkshire stone is a very difficult matter. The best plan would be to paint the stain the same colour as the original stone. The paint must be stippled, not smudged on, and not one person in ten will discover that the stone has been painted.

Dry Rot in Wood.—No method can restore soundness to timber in which dry rot has got a firm hold. All the diseased portion of the timber (and a little more, to be on the safe side) should be completely removed and replaced by good material, and every particle of the fungus should be carefully collected and destroyed, the safest plan being, of course, to burn all chips and dust, as well as the scrapings from the adjacent walls and floor. As a preservative of the new wood and of the undecayed portions of old wood, creosote oil is recommended. Two coats should be very thoroughly applied, with an interval of three weeks or a month between. The creosote oil can probably be obtained at the nearest gasworks, and may be applied with ordinary paint brushes. Carbolineum avenarius has a similar preservative effect. An application of a solution of corrosive sublimate would be quite effectual in stopping the further progress of the fungus, but the solution is difficult to apply in sufficient quantity to fixed woodwork, especially underneath a floor, and the use of this antiseptic is only recommended when steeping the wood is possible. The thorough ventilation of the premises should also receive attention.

Aquarium Construction.—The size of an aquarium to hold about 18 gal. of water will be 2 ft. by 1 ft. 6 in. by 1 ft. deep. The top and bottom frames may be made from iron in one length, 7 ft. long, mitred at the extremities; the mitres at the three angles, cut in the solid,



Aquarium Construction.

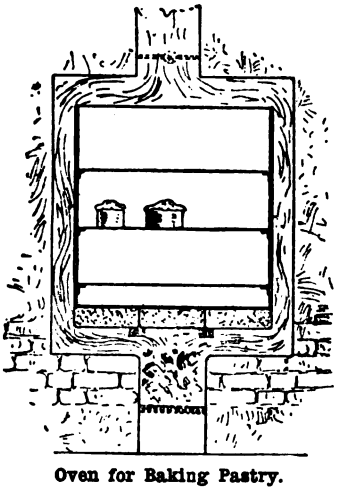
(see Fig. 1) will be best cut out with a hack saw. When cut, the iron should be gently heated at each point and bent in the vice until the mitres meet. The mitre where the two ends meet may be brazed. The angle bars, 10 in. long, must be cut and filed square to butt on the edges of the top and bottom frames; these are held together by shaped angle plates (see Figs. 2 and 3), marked out as shown by Fig. 4. The joints may be made additionally strong by brazing. A coat of paint should be given before bedding the glass to the iron.

Vinegar Plant.—The product known as the vinegar plant grows on the surface of a liquid undergoing acetic fermentation; this plant, in fact, causes the formation of vinegar if allowed to stand in contact with weak alcohol, such as beer or wine. The vinegar plant is really a tough, gelatinous mass of innumerable minute bacteria, and is not a plant in the ordinary acceptance of the term. It can only produce vinegar from weak alcoholic liquids; it cannot convert water into vinegar. The vinegar plant can be obtained by adding a little malt vinegar to ordinary beer, and allowing it to stand in an open bottle for a few weeks.

Lead Plaster.—Lead plaster is made by heating together olive oil, water, and lead oxide for many hours; it is really an oleate of lead.

Moulding Small Crucibles.—Small plumbago crucibles and also fireclay crucibles are usually made in brass or gunmetal moulds. A suitable mould is in three parts—a base-plate; a hollow mould, the inside being shaped according to the outside form of the crucible; and a plug, shaped according to the inside of the crucible. The base-plate is laid on a solid foundation, and the hollow mould is placed on this. Sufficient mixed plumbago is then put in the hollow mould. The plunger or ram is placed in this, and several hard blows with a hammer or mallet are given; this presses the plug into the mould to such a depth as will give a uniform thickness to the crucible. The plug is then withdrawn, the mould taken from the base-plate, and the crucible removed with gentle pressure and placed aside to dry. After being gently heated to drive out excess of moisture, the crucible is ready for use. The inner plug is formed with a shoulder which fits the edge of the mould and so ensures an even thickness of the crucible all round. Great care is needed in mixing the plumbago, or pinholing and other defects will ensue. Large crucible makers use a machine for mixing the materials.

Oven for Baking Pastry.—The accompanying sketch shows a method of forming the flues around an oven in the best manner to ensure the proper baking of pastry. For pastry baking a perfect bottom heat has been found to be essential. The oven can be of sheet-iron, but the two sides should have $\frac{1}{8}$-in. cast-iron plates on them, or the heat may be too great. The bottom of the oven must have a heavy cast plate (say 1 in. thick) to protect it, or can have firebrick slabs carried on strong cast-iron bearers. Something of this kind is essential, or the oven bottom will be overheated; and it will also burn through quickly. The oven should have a frame around the front of it, and the oven door should be



Oven for Baking Pastry.

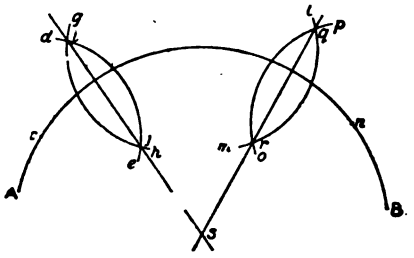
hung as usual. The furnace fittings can be the same as used for a washing copper. The oven shelves should be perforated, or have pieces cut out, to allow the air and heat to circulate. There should be a ventilator to the oven, as pastry gives off considerable moisture.

Jointing Small Wrought-iron Pipe to Large Cast-iron Pipe.—A 4-in. pipe can by a skilled workman be drilled and tapped for a 1-in. pipe, but if any doubt exists as to the man's skill, let small holes be drilled and opened out to about the required size with a diamond-point chisel. A saddle is then fixed on each pipe and the connection made. These saddles are to be obtained from firms who supply pipes, and are sent complete with screws and nuts so as to be fixed without difficulty by anyone; and as they are ready tapped for any size, all the workman has to do is to make the hole in the cast-iron pipe, and a rather rough hole will do.

Re-bottoming a Tub.—Here are instructions on re-bottoming a large tub, the chimb of which is worn. Saw off the chimb until the timber is found to be perfectly sound, and with the hollow draw-knife or adze bevel the ends of the staves to prevent spalling. As the bottom will now be too small, reduce the tub (this is less trouble and expense than making the bottom larger) by removing one stave and taking $1\frac{1}{4}$ in. off the edge. Rejoint the stave on a plane and return it to the tub, then replace the hoops. Level the ends of the staves by planing, then cut the groove or channel with a croze, as illustrated in Series II., p. 53. Now fit the compasses to the groove by going round it in six strides, returning to the same spot as was started from, or $\frac{1}{4}$ in. over. Try the compasses on the bottom, and if it is too large reduce it and plane up the edge to the same width as the groove; if the bottom is too small, take more out of the tub.

Moulding Indiarubber.—The following is the method of proceeding if it is desired to mould a piece of rubber tubing 24 in. long and 4½ in. to 8½ in. in diameter, with ½-in. walls. The pure rubber, after cleaning, is masticated and mixed with one or more of the following—lampblack, zinc oxide, antimony sulphide, china clay, French chalk or silica, and, of course, sulphur, which is added in about the proportion of 25 per cent. of the weight of the rubber to vulcanise it under the influence of heat. These adulterants are almost always used, as pure rubber is expensive. Rubber substitutes and old rubber are also often put into cheap rubber. The mixture is then treated with benzene in a closed chest until it becomes quite pasty and can be rolled out; it is then put through the rollers until it is reduced to the required thickness. The rubber sheet is cut to the desired size, powdered French chalk is dusted on it to prevent sticking, and it is then rolled on an iron core of the internal diameter required until the edges meet. Canvas cloths are now wrapped tightly round the tube to keep it in shape, and the whole is heated in an autoclave at about 150° C. for four or five hours.

Finding Centre of Arch Curves.—The centre points from which different arches are struck can be readily found by practical geometry. The most useful method of finding centres is shown in the accompanying illustration. Let A B be part of the curve of any arch; from any point *c* with a radius *c d* strike the arc *d e*, and



Finding Centre of Arch Curves.

from any point *f* with the same radius strike the arc *g h* to intersect with the previous arc at *i* and *j*, then a line drawn through *i j* will pass through the centre from which the arch curve was struck. Now take any point *k* and with any radius *k l* strike the arc *l m*, and from any point *n* with the same radius strike the ark *o p* intersecting the previous arc in *q* and *r*, then a line drawn through *q r* will intersect with the line drawn through *i j* at the point *s*, which will be the centre of the arch curve. When the arch has more than one centre, the various centres can be found in the same way, by taking different parts of the curve. This is a simple method of finding the centre of any arc of a circle.

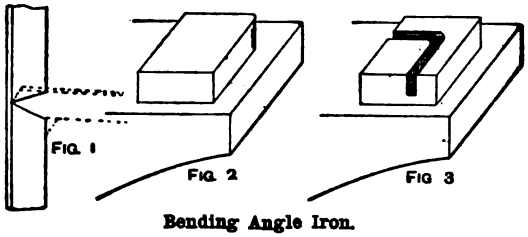
Semi-rotary Wing Pump.—A semi-rotary wing pump has a hollow, drum-shaped head with solid ends, its lower portion being in the form of a sector of a circle, the two radii, or sloping sides, having valves in them which open upwards. A spindle passes through the centre of the ends of the head, and on this spindle are two arms which fit close to the sides and ends of the head. A valve on the upper side of each arm opens upwards. The spindle is made to rotate a quarter of a circle by means of a straight lever handle situated outside. Suction and delivery pipes are attached to the bottom and top respectively of the head or drum. As the outside handle is moved to and fro, the arms inside rock up and down and raise water alternately. The patterns and castings for making such a pump would cost considerably more than the price of a finished article, and a power lathe would be necessary for boring out the drumhead and trueing up the ends. There would also probably be a trespass on patent rights in making such a pump.

Removing Neck of Glass Carboy.—Here is explained how to cut a large carboy top so as to leave a hole about 11 in. across. Fill the carboy with water to the height to be cut, and make an ink mark right round the bottle at that level; this is to serve as a guide for cutting. A crack may be started from the neck of the bottle by tapping with a hammer, and can be led to the ink mark by placing in front of it a red hot iron wire, and moving the wire as the crack creeps on. When the ink mark is reached, carry the crack round the bottle by moving the hot wire in the desired direction. As the glass of a carboy is very thick, the work will be very slow, and a great many heatings of the iron will be necessary. The wire should be very thick, and should be kept perfectly rigid about ½ in. in front of the crack, and moved along slowly. The last inch will not crack, but by the time this is reached the neck of the carboy can be lifted off.

Milk Powder.—Milk powder is made as is condensed milk, by the evaporation of ordinary milk in a vacuum pan at a low temperature and under considerably reduced pressure. For the production of a powder, the evaporation is carried on until the material is quite dry; it is then ground to powder. (See Series II., p. 268.)

Cutting Veneer Squares for Chess Table.—The readiest way of cutting veneer squares when a regular sawing frame is not possessed is to set a cutting gauge to the requisite width and run off sufficient strips of veneer. Shoot the edges with a shoulder plane, then place the strips side by side and run the cutting gauge across them in a transverse direction, when the squares will drop off perfectly true. The edges may also have a shaving taken off with the shoulder plane to square them. Provide a board long enough to hold a strip of veneer, and rebate the board slightly to hold the veneer whilst shooting. When the squares are cut off, place them side by side in the rebate and shoot them.

Bending Angle Iron.—A quick way to make corners in angle iron is to cut a V piece out of the bottom web (see Fig. 1). Scarf the two edges, bend the corner, and then weld up; before welding be sure to bend the corner a little more than the desired angle when finished (as shown by dotted lines) so as to allow for the corner opening during the welding up. If only an odd corner has to be made a tool like Fig. 2 will answer, but if a



Bending Angle Iron.

number of corners are to be forged, a tool as Fig. 3 would be preferable, as the corner can be better welded and can be kept to the proper angle at the same time.

Fastening Watch Mainsprings.—In some cheap Geneva watches the end of the mainspring will be found to be bent back into a hook. It is difficult to bend a spring like this without breaking it. The best course is to rivet a short piece of spring on the end in the reverse direction. The braces for Waltham and similar springs are bought ready made and riveted on. The spring only needs a round hole punching in its end, which is opened out by broaching to fit the rivet on the brace. The spring of a fusee watch has a round hole punched in it. This hole is opened by broaching and filing to an oval shape, leaving a knife edge on the outside to hold the hook. Oblong holes need a mainspring punching tool and are of no advantage.

Modulus of Elasticity.—Dr. Thomas Young invented a modulus of elasticity which was the modulus of direct elasticity expressed in feet, being the height to which a body would have to be piled in order that any small addition to its top, of its own substance, might compress the remainder of the body to an extent equal to the thickness of the added quantity. Hooke's modulus was the weight in lb. that would stretch a bar having a sectional area of 1 sq. in., by an amount equal to its own length. The modern definition of the direct modulus of elasticity is "the ratio of the stress per unit of section to the strain per unit of length produced by that stress." Expressed in lb. the modulus of elasticity (E) is the tensile or compressive stress in lb. per sq. in. sectional area divided by the elongation or shortening in inches per inch in length. The figures are E = for mild steel 29 millions, wrought-iron 26 millions, cast-iron 18 millions, hard wood 2 millions, soft wood 1½ millions. The modulus holds good only within the limits of elasticity, that is, so long as the strain is sensibly proportional to the stress, or in general up to about half the breaking weight.

Reviver for Felt Hats.—The following is a reviver for black felt hats. Take 1 lb. of logwood chips and boil with 1 qt. of water for two hours; strain, add a little water to the chips, and again boil and strain; make the total up to 32 oz. if below that bulk. Dissolve in the solution 1 oz. of chromate of potash (not bichromate), when the reviver is ready for use.

Enamel Painting Cycle Olive Green.—It is necessary to remove the old enamel with a blunt knife, finishing by removing all small particles with superfine emery-paper until a perfectly even surface is obtained. Dust well, and apply a coat of olive green enamel made by mixing together 1 lb. of paste coach green ground in turpentine with 1 oz. of lemon chrome, thinning down with 6 parts of outside copal varnish and 1 part of pale gold size. The best and most even surfaces are obtained by slightly warming the enamel before use. The enamel, if mixed in the above proportions, will dry hard in a few hours with an excellent gloss, and will not crack or chip off. The appearance of the cycle may be somewhat improved by lining out with middle chrome paint.

Pigeon Trap.—Fig. 1 is a design for a pigeon trap, 2ft. 10in. long by 1ft. 6in. deep by 1ft. 3in. wide, the top to open by means of a pull y arrangement, and the front to drop. It is framed together with 1½-in. by 1½-in. deal, with a back of ½-in. matchboarding, and a bottom of ¾-in. matchboarding. The lid may be framed together of 2-in. by 1-in. stuff, and either divided into 4-in. squares with wires, as shown, to enable the pigeons to get in when the trap is closed or catch any stray ones that may be about, or the lid may be boarded over. The front and sides are covered with wire netting, except the upper portion of the front, which falls down to form an alighting shelf when the trap is open, and closes up when the lid falls. Fig. 2 shows the arrangement for working the trap. The lid is hinged at A, and a lever B made of

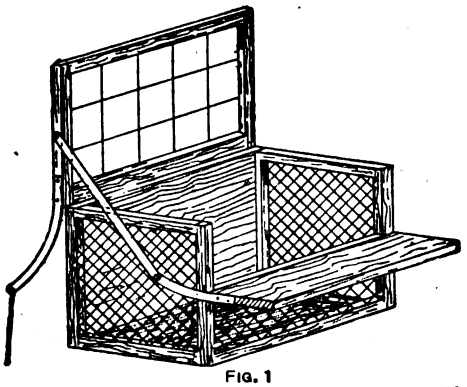


FIG. 1

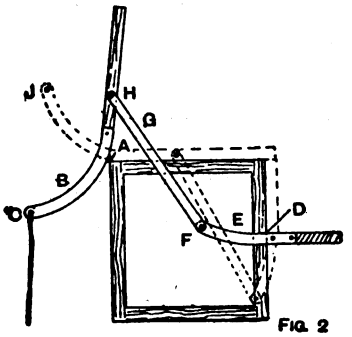


FIG. 2

Pigeon Trap.

1-in. by ⅛-in. bar-iron is secured at one end on the hinged side by a couple of screws. A cord is attached to the other end at C. The top of the front is hinged at D, and fitted with a lever E similar to B. A connecting-rod G is attached to this lever at F by a small bolt, and the other end of G is attached to the lid at H by a wood screw. The dotted lines show the trap closed, when the cord will be at J, and it will be clear that by pulling this cord the lid will open and the front flap will be thrown down, when the other end of the cord must be secured to a cleat or a hook. On releasing the cord, the weight of the lid closes the trap.

Sizing Gilt Face of Clock.—Varnish should not be needed on a gilt clock face. If the gold was evenly and well put on when the size was at the right state of tackiness, a thin coat of size, as clear as possible, is all that is required; parchment size such as picture-frame gilders use is preferable. When the face of the clock becomes dirty through dust or other causes, the size can easily be taken off with a little warm water, thus removing the dirt, and a fresh coat given. This is the most durable method of protecting the gold on a clock face; varnish takes away the brightness of the gold and imparts a brassy appearance.

Making Vinegar from Sugar.—By a quick process of making vinegar a cask is fitted with a partition a few inches above the bottom; this partition is perforated, and above it is loosely laid a heap of hardwood shavings or vine twigs which have previously been boiled with water. The shavings nearly fill the cask, and a few inches from the top of the cask a perforated lid is fitted in. Each of the holes in this lid is fitted with a glass tube rising about 1 in. above the surface of the wood, and through each tube is passed a wick of untrimmed cotton yarn. In the side of the case, between the bottom and the partition, is a hole plugged with a cork, through which passes a glass tube bent round in the form of an inverted U, so that it serves as a syphon. The process is started by passing through the cask some vinegar, preferably some with the fermentation in progress, for the purpose of inoculating the shavings with the vinegar ferment; two or three inches of the liquid to be fermented is then poured on the upper partition; the liquid passes slowly through the cotton wicks and drips on to the shavings, where the fermentation takes place, and then falls to the bottom of the cask, and when the liquid reaches the level of the upper part of the glass tube it syphons out. If the cask is placed in a warm room and the ferment is in full activity the liquid will at once be changed into vinegar. Slightly diluted beer should be used for making vinegar, but if the vinegar is to be made from sugar, then the sugar solution must be fermented for twenty-four hours with yeast in an open tub before putting it through the vinegar cask. If the vinegar is not quite clear, filter it through a piece of white blotting paper folded in a funnel. For further particulars, see Series I., p. 265.

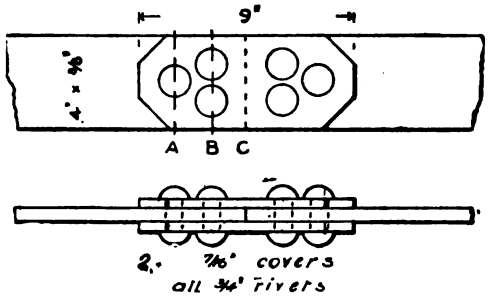
Replacing Head in Cask.—Below is explained how to replace an undowelled head (removed for cleaning purposes) in a cask. Replace all the pieces of the head in their original positions. Nail a strip of wood across the joints to keep the pieces together, taking care that the nails do not go quite through. Return the head to the cask in the same position it was before being taken out (the position should have been marked with a punch or chisel). If in doubt, look for the impression that each stave makes on the head. Take off sufficient hoops to allow the staves to spring open, place the head in the cask and pull towards you, the cask lying on its side; tighten the hoops sufficiently to hold the head in place, and any portions that refuse to come into the groove easily can be lifted in by means of a thin but blunt table knife or a thin piece of iron inserted between the joints of the staves; a small rush as used by coopers placed all round the groove would make doubly sure. To peg the head together, in one piece of the head at 4in. from each end bore a hole, then place a piece of chalk in the holes bored and rotate for the purpose of marking the inside edges of the hole. Place this piece of the head on the top of the next piece in the position required and then strike smartly with the hammer once, when an exact imprint of the hole will be seen on the piece underneath. Bore the holes out with brace and dowling bit and fit the dowels to the holes tightly, then proceed with the other pieces in a similar manner.

Papier-mâché.—Papier-mâché is made from paper pulp, which may be produced on a small scale by boiling white blotting paper with water and beating it to pulp. On the large scale, papier-mâché may be made from white rags or wood pulp. The pulp should be drained as much as possible of its water, and then mixed in a kneading machine with about one-eighth to one-fourth its weight of whiting and just sufficient glue size to make it into a stiff paste. It may be moulded easily by hand pressure in a small screw press. For white papier-mâché all the materials should be absolutely white, and parchment size or gelatine should be used; but for coloured papier-mâché, glue size can be employed. The pulp can be coloured by any mineral pigment, as lampblack, ochre, etc., or may be tinted with aniline dyes. The pressed boxes should be dried slowly, or they will not keep their shape. As papier-mâché, if kept in a damp place, would become mouldy, it is better to varnish or lacquer it, after applying a coat of size.

Patching Worn Nickel-plating.—Compositions for patching the worn parts on nickel-plating are not to be recommended for several reasons, and must be regarded as makeshifts, similar to that of tying a broken part with string or wire, instead of soldering or brazing the joint, or painting a worn spot in the enamel. Worn parts in the plating and the enamelling of cycles can only be thoroughly repaired by getting off all the old coats, and putting on new ones.

Scorched Chrome Leather Boots.—If the scorch is very bad, the best thing will be to cover up the defective place with a piece of leather to match as nearly as possible the colour of the boot, using Sand's cement. Skive the bad part from the boot, and round and skive a piece of new leather to cover the scorched place. The scorched place and the new patch should receive each a coat of the cement; if the leather is not white all over when dry, give a second coat of cement, and when the cement has dried white, warm the two surfaces, place them together, and when cold the boots can be worn. If time will not permit of a patch being put on in the manner described above, the hardness of the burnt part may be somewhat neutralised by a little warm water.

Joining Wrought-iron Plate.—Suppose a wrought-iron plate, 4 in. wide and ¼ in. thick, to be built into a large block of concrete, 18 in. of the plate projecting vertically, and that it is desired to join a second plate of the same size to the first so as to obtain the maximum strength in tension. A double-cover riveted joint, shown in the accompanying illustrations, is the best. The full strength of the plate will be $4 \times \frac{1}{4} \times 22 = 55$ tons. Each ¾-in. rivet would have an ultimate strength in double shear of 15 tons, or 40 tons per sq. in. bearing pressure. The resistance to fracture through the first rivet hole A would be $(4 - \frac{3}{4}) \times \frac{1}{4} \times 22 = 44{\cdot}7$ tons. The resistance to fracture through B and shear A would be $(4 - 1\frac{1}{4}) \times \frac{1}{4} \times 22 + 15 = 49{\cdot}4$ tons. The resistance to shear all the rivets on one side would be $15 \times 3 = 45$ tons. The resistance to tear the covers at C would be $2\ (4 \times \frac{1}{4}) \times 22 = 66$ tons, but



Joining Wrought-iron Plate.

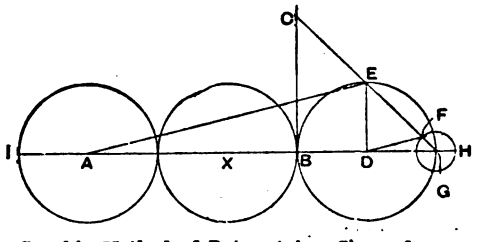
this could not happen, owing to the loss of section in the adjacent rivet holes making a weaker line. The resistance to tear the covers through B would be $2 \times (4 - 1\frac{1}{4}) \times \frac{1}{4} \times 22 = 41{\cdot}25$. The resistance to crush all the rivets in the holes on one side of joint would be $3 \times \frac{3}{4} \times \frac{1}{4} \times 40 = 56{\cdot}25$ tons. The weakest part is therefore the tearing of the covers through B. This may be improved by increasing the thickness to $\frac{7}{16}$ in. each, when the strength will be brought up to $2\ (4 - 1\frac{1}{4}) \frac{7}{16} \times 22 = 48{\cdot}1$ tons, leaving the weakest part now through the plate itself at the first rivet hole, and as the number of rivets here cannot be further reduced, this is the maximum strength, or an efficiency compared with the original strength of the plate of 81 per cent.

Inserting New Tube in Barometer.—When replacing an old tube in a barometer by a new one, it is always well to obtain the new tube as nearly as possible like the old one, not that it makes very much difference, except where the graduated scale is corrected empirically, as in marine barometers, so as to get rid of the error of capacity. This correction depends on the relative diameters of tube and cistern; but where there has been no such correction, the shape of the tube is immaterial. As the pressure which the mercury exerts by its weight at the base of the tube is independent of the form of the tube, provided it is not capillary, the height of the barometer is independent of the diameter of the tube and its shape, but is inversely as the density of the liquid.

Moulding Carnauba Wax.—Carnauba wax, which is obtained from the leaves of a variety of palm tree growing in Brazil, is very brittle and shrinks very much on cooling; on coming in contact with the cold mould the wax solidifies on the outside, while the inner portion is fluid, and this sets up great stress which fractures the mass. To mould it properly, have the moulds (which may be of iron or brass, or even tinplate) much larger than the tablets required, and bring them to a temperature above the melting point of the wax, *i.e.* 81° C. Add 5 or 10 per cent. of tallow to the wax and then cast; then put the moulds in a warm place, free from draught, and allow to cool slowly. The colours to be used will depend on whether an opaque or a translucent wax is required; if opaque, for red use venetian red; for red brown use burnt umber; and for brown use umber. If translucent colours are required, instead of tallow use 5 per cent. of oleic acid (olein), and add sufficient of one of the aniline colours soluble in oil to give a tint only; the amount required will be found to be very small.

Brown Stains for Oak Picture Frames.—For a light brown stain for oak frames, dissolve ½ oz. of bichromate of potash in 1 pt. of rainwater, and add brown umber in dry powder form till the tone desired is gained. To prepare a dark brown oak, mix the potash solution as above with vandyke brown instead of umber. Or, as an alternative plan, mix the vandyke brown with liquid ammonia to the consistency of paint, then thin out by adding rainwater. To use the stains, apply liberally with a hog-hair brush (a painter's sash tool), then with a piece of coarse rag rub the stains well in, wiping off any surplus, but always finishing in the direction of the grain. As the solutions have a darkening effect on oak, irrespective of the pigments that are added, it will be advisable to experiment first on a few odd pieces of similar woods.

Graphic Method of Determining Circumference of Circle.—The following is a graphic method of determining the circumference of a circle, the error being but about $\frac{1}{18,500}$. Required the circumference of a circle having its centre at X in the illustration. Produce the diameter both ways, describe two circles equal to the given circle and having their centres A and D on the produced diameter, each circle touching the given circle at opposite sides. Erect a perpendicular radius D E. Join A to E and E to G, and draw D F parallel



Graphic Method of Determining Circumference of Circle.

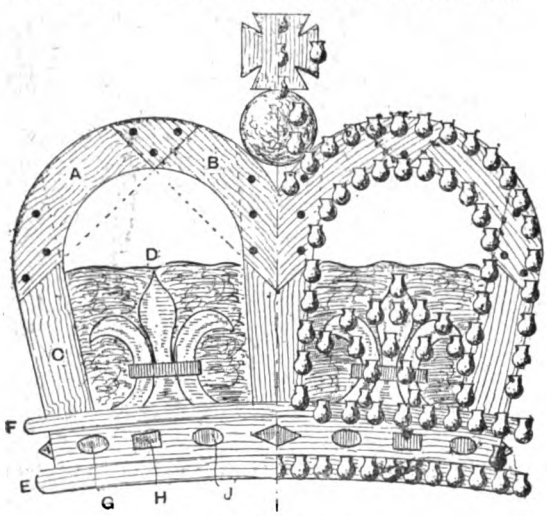
to A E. With G as centre and G F as radius describe a circle. Then H I equals the required circumference of circle. For the proof, draw B C perpendicular to A D, and make it equal to the diameter of the given circle. Produce G E, when it will meet B C at C. Then $G C = \sqrt{2} = 1{\cdot}4142$ the unit being the diameter of the circle. G F = G H and it can be shown that $G F = \frac{E G \times D G}{A G} = \frac{\sqrt{2}}{10} = 0{\cdot}14142$. Thus H I = three diameters + G H = 3·14142. The true circumference is 3·14158 (approx.), the difference being ·00016.

Stamping Blacklead Pencils.—For stamping the plain letters on blacklead pencils, at some works two circular dies are fixed with their edges nearly touching. The edges are grooved to the diameter of the pencils, or a little less, and the dies are kept together by springs. On the groove of one die raised letters are fixed, and the pencils are pushed between the dies, and fall out on the opposite side stamped. The dies are so arranged that the letters are brought back to the front side after the stamped pencil has dropped. For gilt letters, the stamp works in a vertical guide, and is heated by a small gas jet, the pencils being coated at the proper place with gold size. A strip of gold-leaf is then laid on, and the pencil is placed in a rest formed under the stamp, which is pushed down by hand, this forms the letters, and pushes in the gold at the same time. The surplus gold-leaf is rubbed off into a box with a piece of clean cloth.

Black Liquid Polish for Leather.—Herewith are three recommended recipes for a black liquid polish for leather. (*a*) Take ½ oz. of isinglass or gelatine, ½ oz. of powdered indigo, 4 oz. of soft soap, 4 oz. of logwood, and 5 oz. of glue; boil these in 2 pt. of vinegar till the glue is dissolved, then strain through a cloth and bottle for use. (*b*) Melt 8 oz. of beeswax in an earthen pipkin, and stir into it 2 oz. of ivory black, 1 oz. of Prussian blue ground in oil, 1 oz. of oil of turpentine, and ½ oz. of copal varnish. Make this into balls. Apply with a brush, and polish with a soft rag. (*c*) Mix well together 4 oz. of treacle, 4 oz. of lampblack, a tablespoonful of yeast, and a teaspoonful of oil of turpentine; apply with a sponge; no brushing is required. Each of the above preparations should be kept in a cool place.

Dull Black for Wrought Ironwork.—The following is a recipe for a quick-drying dull black for wrought ironwork. Melt in an old iron vessel 1 lb. of asphaltum and 1 lb. of coal-tar pitch; simmer for half an hour, and allow it to cool somewhat, then add 1 pt. of boiled oil. Place the mixture over the fire again, and raise it to a good heat, then add ½ lb. of litharge while constantly stirring; boil for some minutes until the mixture turns stringy. Allow it to cool down slightly, and steadily add ¾ gal. of turpentine. In another vessel dissolve 1 lb. of beeswax in ¼ gal. of turpentine, and stir this into the above preparation, which will give to it a dull surface when dry. The quantity of beeswax to be added will vary according to the finish required. Another method is to procure 1 gal. of black japan, and add to it 1 lb. of beeswax dissolved in ¼ gal. of turpentine; stir well together, and add ½ pt. of terebine.

Illuminated Crown.—The illustration herewith shows a sketch of a crown for outside illumination in woodwork, to take fairy lamps, the base of the crown to be about 5 ft. and the height 4 ft. Alterations and improvements can be made to suit individual taste. A and B are cut from 9-in. board ¾ in. thick; C is cut from 6-in. stuff. Each fleur-de-lys is cut out and fixed on the background D,



Illuminated Crown.

which is painted with one coat of red-lead, on which is put a thin coat of Indian red and varnish to represent the velvet of the crown. The crown, as it is only used as a peg to hang the lamps on, could be painted either black or in ochre. The jewels in the band could be cut out, and green, blue, and ruby glass, with lights behind, placed at the back of the openings G, H, and J. Round the arc of the crown the lights should be white, to represent pearls; on the band F the lights should be yellow, to represent the golden cord, and on each fleur-de-lys also yellow. At E the lights should be white, to represent the ermined band. Four yellow lamps could be clustered in the orb and five on the Maltese cross, one in the centre and one on each side and at top and bottom.

Fixing Register Grate and Mantel.—The following are particulars on fixing a register grate and mantel. The jambs and frieze of the mantel, in the first place, must be offered up and their inner edges marked to show the position of the grate. In fixing an ordinary register grate which is wholly ironwork (except for two or three small firebricks in the firebox) the grate is merely stood in the chimney opening, then through the register aperture the space behind the grate is filled up with brickwork. For good working, the grate should be filled up behind and all around the sides, and the filling is also necessary in order to prevent soot accumulating. If the grate is a modern one, having all firebrick back and metal front, then the mantel and the grate front must be offered up to show the position of the bricks, as these are fixed first. The bricks are stood in position and well bedded round with mortar (lime) concrete, then the front is put up and may or may not be secured to the firebricks with bands or clamps. Sometimes the bricks and the front are sent from the works secured together, and in such case the grate is fixed like the iron register grate as explained above. Mantels are fixed jambs first, and these are secured to the wall by iron clamps; then comes the frieze, which requires no securing, but a slate plinth will probably be sent to fit in between the lower edge of the frieze and the grate. Then comes the shelf, and as a rule a chase, about 1 in. deep, is cut in the wall in order to let the back edge of the shelf go in, and is made good with cement.

Emery-wheel Grinder on Sewing-machine Stand.—Below are instructions on converting an ordinary sewing-machine stand into a treadle emery-wheel so that the wheel can be covered with the machine cover. Most emery grinders have the pulley fixed about the centre of the spindle (see Fig. 1), and frequently have an emery wheel attached to each end, or an emery wheel at one end and a polishing buff at the other. But if it is desired to use the machine cover in exactly the same position as for the sewing machine, the better plan would be to purchase a cheap emery grinder (Fig. 1), and adapt it to the sewing-machine stand. The grinder is constructed to hold an emery wheel at one end and a drill chuck at the other, but the pulley is

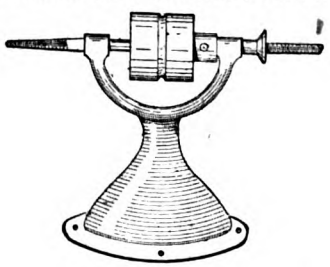


FIG. 1

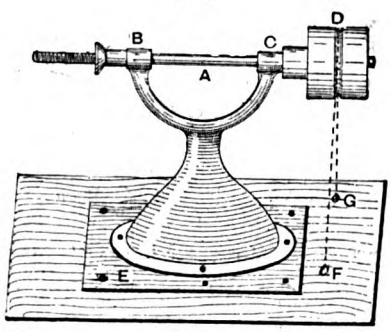


FIG. 2

Emery-wheel Grinder on Sewing-machine Stand.

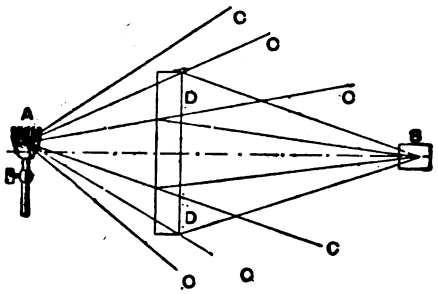
in the centre of the spindle. A set of castings for the above, which consists of the following, should also be bought. One stand, 6-in. centres with two adjustable bearings cast on, two brass clams, one spindle, and one pulley, and boring and cutting bearings. Proceed to build the grinder as Fig. 2. Insert the spindle A in the bearings B and C, and attach the pulley D on the right-hand side of bearing C. To fix the grinder to the stand, get a deal board E, 9 in. by 1 in., and of sufficient length to cover the hole in the machine table, and secure it with six 1½-in. No. 12 wood screws; place the grinder on top of this board, attach a belt from pulley D to the driving wheel on the stand through the holes F and G in the table. Should the belt bind fore or aft, slot the belt-holes. Set the groove in the pulley D in line with the driving pulley and fasten the castings with wood screws. The depth of the machine cover should be taken into consideration when ordering the casting for the grinder so as to obtain one sufficiently low; 5 in. from base to centre of bearing would be a convenient height.

Colour Wash for Yellow Stock Bricks.—Below is a recipe for a colour wash for an old yellow stock brick wall. The colour of the bricks may be imitated by using, in varying proportions, slaked lime and yellow ochre; if a darker shade is required, add a small quantity of dry umber. To each bucket of wash add 1½ lb. of alum or of white copperas. The proportions given below will suffice for most purposes. Lime, 14 lb.; yellow ochre, dry, 7 lb., and 1 lb. of either alum or white copperas, or green copperas; about 2 gal. of water or sufficient water to make a wash of the required consistency should be added. Apply with a fairly stiff brush.

Emerald Green Enamel Paint.—Green enamel paint may be prepared with emerald green ground in varnish 2 lb., maple or carriage varnish 2 pt., gold size ½ pt., and turpentine ½ pt. Mix the green to a uniform consistency with the varnish and gold size by adding it gradually, finally thinning down with the turpentine. The simplest method of obtaining an even surface is to slightly heat the enamel over the fire and apply it whilst hot, laying it off rapidly and evenly with a fine sable-hair brush, and allowing it to dry in a warm atmosphere.

Treatment of Rusty Piano Wires.—When a piano has got rusty throughout in consequence of damp, take the instrument apart and leave it open for a week at least, so that air can play freely around its parts to dry up any moisture. A warm room and sunshine will be beneficial. The instrument may also be freely used to prevent any centres swelling and working stiffly. The action should be taken out to enable the wires to be lightly brushed with a blacklead brush that has been used on grates. Remove any dust by means of bellows, then wipe the wires over with vaseline applied on a washleather. Should the instrument be in a very bad state, more thorough treatment will be necessary.

Difference between Photographic Lens and Condenser.—A lens is a disc of some suitable substance (usually glass) whose surface is fashioned into a more or less spherical shape; it is capable of transmitting and refracting light rays. Lenses have been made of glass, water, Iceland spar, quartz, and even of ebonite. Generally speaking, a condenser, although a lens, is



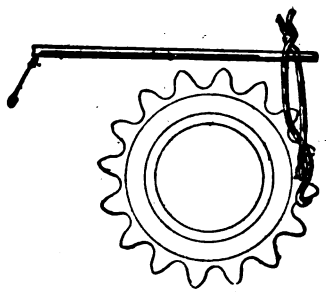
Design showing Use of Condenser.

used for a slightly different purpose than the ordinary photographic lens. A condenser usually consists of two glasses (one side of each of which is flat and the other spherical) fixed in a tube, the curved surfaces of the glasses being together; the condenser is used to bend together the rays proceeding from a small source of light. For example, in the illustration, if the gas flame A is used to illuminate the openings B, all those rays of light proceeding in the direction C will be lost; but if a condenser D is put in the path of the rays, they may be bent together and used to enrich the light. A condenser, therefore, is a lens of large diameter that is used for the purpose of obtaining brighter and more even illumination when enlarging small pictures. Condensers need not be (and usually are not) corrected for the various faults or aberrations that lenses are liable to, and cannot therefore be used for the same purpose as an ordinary lens. Condensers are used chiefly in lanterns for enlarging and projection, and small ones are in use for illuminating opaque objects that are being examined in the microscope.

Maize Starch.—The following is an outline of a largely used process for preparing maize starch. The grain is steeped for three days in warm water at a temperature of 60° C., and a small quantity of bisulphite of lime or other preservative is added to prevent fermentation. The wet grain is then ground between rollers and passed to shakers, which are long cloths stretched on frames kept in constant motion. The shakers act as sieves, allowing the fine material to pass through, while the coarser material is kept back and put through grinding rollers again. The liquid containing the starch in suspension falls through the shakers into large vats which, being conical at the bottom, are called settling cones; in these the starch is allowed to deposit and the water is run off. The wet starch is next run into mixing vats, a large amount of water added, and also a small quantity of alkali to neutralise the acid generated. The starch is allowed to subside, then is run on to tables and the water run off; a second washing with water, followed by subsidence, is usually given to remove the impurities. The purified wet starch is run into wooden boxes, made slightly taper and with a perforated bottom to allow of drainage. After draining, the starch slabs are emptied on to a table, from which the remaining water is removed by a vacuum pump, and the blocks of starch are loaded on trucks containing shelves and then run into drying kilns. These are built of wood, and hot air is drawn over steam pipes right through the kilns by means of a fan. There are also subsidiary operations connected with the removal and treatment of the germ and oil, which now are also valuable products.

Irregular Stitching in Sewing Machine.—The variation in a sewing machine stitch may be caused by the feed being too low or the teeth not sharp enough. For wax-thread work the feed should be at least $\frac{1}{11}$ in. above the needle-plate when the needle-bar is at its highest point. If too low, dovetail and braze a piece on the under side and file it until the required height is obtained. If the teeth are worn smooth, soften the feed in the usual way and recut with a three-square file. Another cause of irregular stitching may be the general looseness of all the feed and stitch regulating parts. To test this, turn the wheel of the machine until the needle-bar is at about its highest point of travel and the feed about to move to make the stitch, then with the thumb and finger try to move the feed backwards and forwards; if by so doing much movement is obtained, it will be obvious that some parts are worn and must be refitted or replaced by new ones.

Removing Chain Ring of Cycle.—The accompanying illustration shows a simple makeshift device that cyclists may employ in removing a tight chain ring, which



Removing Chain Ring of Cycle.

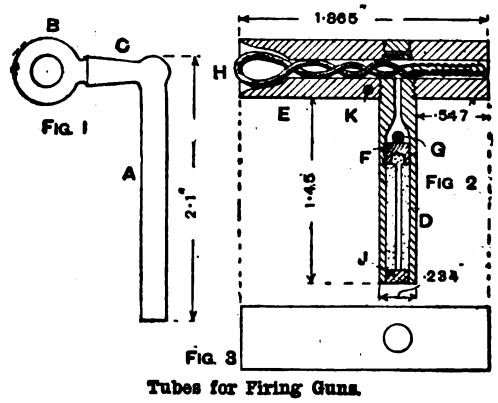
is often a troublesome affair when a chain-ring wrench is not available. A piece of stout wire is bent as shown to fit over the teeth, and an iron bar or anything handy is inserted to act as a lever. This will be found to move any chain ring, however tight.

Discoloured Hot Water.—The red-brown discoloration of water in a hot-water apparatus is due to rust, which is probably caused by the nature of the water, which presumably is soft and has a solvent action on iron and steel. Soft water also attacks zinc (and lead) just as freely, so that the galvanisation of iron is not a protective. If any iron is in the apparatus (the pipes, for instance), the discoloration of the water is accounted for. If all the apparatus is now of copper, the trouble is caused by sediment, and the discoloration would only be noticed when the water is agitated by, for instance, boiling. If the pipes are of iron, they had better be changed to copper. Some people use lead, but the water may attack this metal, and although the dissolved lead will not be visible, it will be a source of risk, owing to its poisonous properties, if the water is used for filling kettles, etc.

Repairing Water Jacket of Gas-engine Cylinder.—In the case of the outer shell of a gas-engine cylinder jacket having had a piece broken out by frost, the only repair that is reliable and can be recommended is the following. Have a piece of wrought plate forged to the shape of the cylinder where the fracture is and about 2 in. larger all round. Assuming the broken piece can be put in place without dropping through the hole, bed it in with mixed red- and white-lead about as thick as stiff paint, then with the same mixture paint over the inner side of the forged plate and the surface of the cylinder it will come against. Next mix red- and white-lead to the consistency of sticky putty and into this work some chopped hemp. With this make a plaster a full ¼ in. thick over the inner side of the forged plate, and then bed it soundly on the cylinder, entirely covering the broken place, of course. The plate is then secured by ⅛-in. or ¼-in. set screws placed about 2 in. apart.

Removing Stain from Dressed Stones.—In packing newly wrought stones in oak shavings, the dye from the shavings may be found to penetrate the stones, the bluish stain being no doubt a tannate of iron, the tannic acid coming from the shavings, and the iron is present in the cream coloured sandstone. The stain may be removed by soaking the stones for several hours (or perhaps longer) in dilute hydrochloric acid (1 pt. commercial hydrochloric acid or spirit of salts to 10 pt. of water); after the acid bath the stones should be soaked in water for a day or two, and then left in a clean place to dry.

Tubes for Firing Guns.—Guns are fired by means of two kinds of tubes, one firing charges of black gunpowder, the other firing charges of cordite. The latter are called vent-sealing tubes. In the first kind (Fig. 1), the tube A is of solid-drawn copper and has a solid head B; it is about ½ in. in diameter, and 2·1 in. long. The inside is filled with pistol powder, and the bottom is closed with a cork plug secured by shellac. Across the top of the tube is inserted a nib piece C or short cylinder of sheet copper. This nib piece contains a copper friction bar roughened on both sides and covered with a detonating composition. The nib piece is pinched down so as to press on the sides of the friction bar, the projecting part of which has a vertical eye into which the hook of the lanyard fits. On pulling the lanyard (which should be stretched and then sharply pulled) the friction bar is

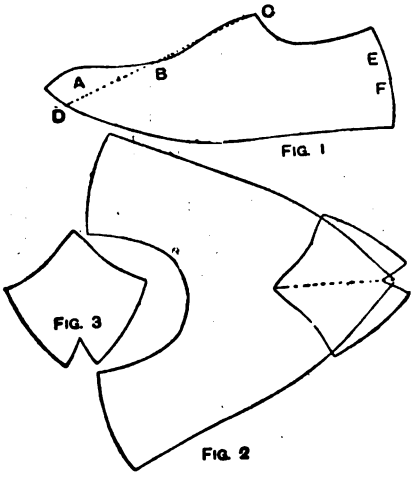


Tubes for Firing Guns.

drawn out, igniting the composition and firing the tube. The gas from the exploded cartridge drives this tube out of the vent. The vent-sealing tube (Fig. 2) has been adopted for use with cordite, to prevent the gas on discharge rushing up the vent, and so scoring it and making it become dangerous. The tube consists of a body D, head E, ball F, plug G, and friction wire H. The head is of gunmetal, the body of solid-drawn brass, the ball of soft copper, and the friction bar of doubled copper wire, the bight being formed into a loop and the ends twisted together and roughened. A hole in the head of the tube, over the friction wire, is charged with about 2 grains of detonating composition in the form of a paste, laid over the roughened portion of the wire. The body is charged with 8 grains of pistol powder, and is closed with a cork plug J. A brass pin K is inserted to prevent the body becoming unscrewed. The upper part of the body has a central perforation which is enlarged in its lower part into a conical recess. The ball E is placed in this recess, and is retained therein by a screwed plug G pierced by three fireholes. On withdrawing the friction bar the detonating composition is ignited, and the flash passing down the perforation in the head and through the plug, fires the powder charge. The ball is driven upwards by the explosion and seals the tube. This, together with the manner in which the tube is held in the special vent employed with it, prevents the rushing of gas through the vent.

Pike Fishing Rod.—A three-part rod may be made to these dimensions. Butt, 4 ft. 6 in. long, with a ¼-in. diameter ferrule at the top; middle joint, ⅜ in. in diameter at the counter and ½ in. at the ferrule, both joints to be made of bamboo; top, ¼ in. in diameter at the counter, tapering to ⅛ in. at the point, made up by splicing 2 ft. of lancewood on the top of 2 ft. 6 in. of washaba or, if this cannot be obtained, hickory or ash. A four-part greenheart rod may be made to the following dimensions. Butt, 3 ft. 6 in. long, 1¼ in. in diameter at the handle, and ½ in. at the first ferrule; second joint, 3 ft. 6 in. long, and ⅜ in. in diameter at the second ferrule; third joint, 3 ft. 6 in. long, and ⅛ in. in diameter at the top ferrule; top, 3 ft. 6 in. long, and ⅛ in. in diameter at the point. A light rod may have the lower joints of pine or red deal with a lancewood top or a spliced top as for the bamboo rod, and may be to the following dimensions. Butt, 3 ft. 4 in. long, tapering from 1¼ in. to ⅝ in. in diameter; middle, 3 ft. 4 in. long, and ½ in. in diameter at the ferrule; top, 3 ft. 4 in. long, tapering to ⅛ in. in diameter at the point.

Hollow Boot-last.—Below are instructions on making a boot-last with the instep fixed, not loose as in ordinary lasts. The form of the last is to be hollow, so that a wood bottom can be fixed in. Make a last with soft buckram; as two or even three thicknesses of buckram will be necessary, it will be best to cut the pieces so that all the seams will not come in one place. Cut out the last to Fig. 1, noting specially that it should be rounded off at the top of the toe as at A. Two of these pieces will be needed for each last, unless three thicknesses of buckram are used, then four pieces will have to be cut. Now fold a piece of paper and get the fold as level as possible to BO, as shown by the dotted line down to D, and cut it out to the first pattern. This will



Hollow Boot-last.

give, when open, the shape of Fig. 2; a piece can be cut to this, and another to Fig. 3, in the form of a toe-cap (see Fig. 2). Before working the pieces, each one can be steamed or slightly damped. Take one piece (Fig. 1) and tack it, as when lasting a shoe, to one side of the last. Treat a similar piece for the other side in a like manner, paste the edge (using bookbinders' paste or a mixture of glue and paste) for about ½ in. up ABC (Fig. 1) and EF, and last that in a similar way, letting the edges overlap so that one edge may adhere to the other up the front and back, putting in a few tacks to keep the edges in place till dry. When thoroughly dry, last on the one layer (Fig. 2) and give the whole a coat of paste, then paste on the cap (Fig. 3), lasting each piece over as for the upper of a shoe, and when this has set the two pieces similar to the first may be put on. When dry, give a coat of plaster-of-Paris and whiting, and when this has set quite hard smooth off with fine sandpaper and paint any colour desired. The lasts could also be made with several layers of brown paper or thin strawboard, which can be pared off with a sharp knife. When finished, the bottom rough edges can be cut off to the bottom of the last, ready for the wood bottom. If a very solid last is needed, a good method would be to coat the last with thin paper, and encase it with papier-mâché; when quite set, rasp or file off any roughness. By this means on, say, a pointed-toed last, any shape could be got, as it would only mean adding a little more papier-mâché where needed.

Cleaning Telescope Lenses.—Telescope lenses when returned to their fittings after having been removed for cleaning must occupy as nearly as possible their former positions. It would perhaps be wise to clean each lens separately, carefully marking with a lead pencil the edges of the lenses in the objective and the cell, so that when the lenses are returned the lines are guides. The eyepiece lenses that are burnished into their cells present no difficulty. To clean the lenses, first sponge the surfaces with cotton-wool dipped in spirit of wine, then polish with a fine cambric pocket handkerchief.

Adapting Roll-holder to Pocket Camera. — The simplest plan of employing films with a pocket camera constructed to take plates would be to use cut films; this would not involve the alteration of any portion of the apparatus, the films being merely slipped into the dark slides like plates. The accompanying illustrations show the construction of a roll-holder. Fig. 1 is a plan of the holder, which consists of a box frame with open sides from A A and B B. Along the top and bottom of each side is a groove C, which permits the front part D to be slid in, making the whole light-tight; catches are fixed as at E (Fig. 3). This front (Fig. 2) is like an ordinary pocket dark slide, but has wings or side-pieces D to run into A A and B B, and at F is fixed a sheet of vulcanised fibre with an opening the size of the required picture. The shutter G may be of similar material. Fig. 3 is a perspective view. Attached to the back of the frame is a skeleton block (shown by the double line H, Fig. 1), which serves to keep the two rollers I and J in position; two other rollers, K and K¹, are fixed, one on each side of the front frame. The roller K is provided with pins L (Fig. 4) in the side; the circumference of this roller being exactly equal to the diameter of the picture, the perforations made by the pins serve as a guide in cutting up the film previous to development. A reference to Fig. 4 shows

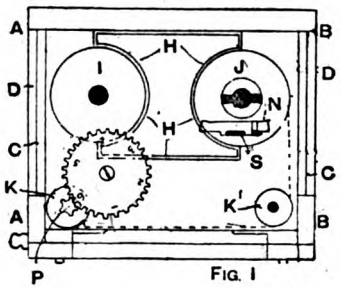


FIG. 1

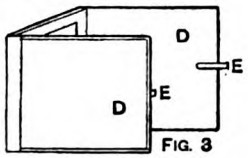


FIG. 3

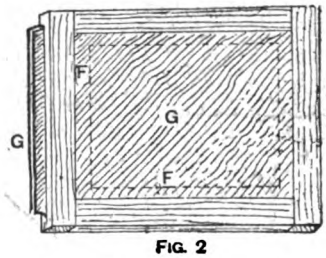


FIG. 2

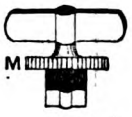


FIG. 5

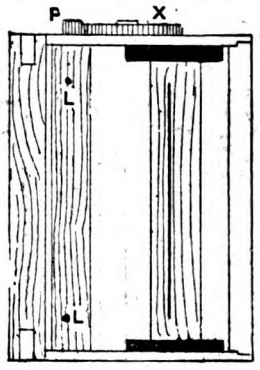


FIG. 4

Adapting Roll-holder to Pocket Camera.

that this roller terminates in a pinion P, having five teeth, which engage with a cog-wheel X having thirty teeth. The cog-wheel is marked with numbers, so that the number of exposed films may be easily read off. The cog-wheel is loosely fixed with a screw into the framework. Fig. 5 shows the key that turns the roller carrying off the film, which drops through the top, the part M coming flush with the surface of the frame. The catch N (Fig. 1) is then turned over M, and holds it in position; whilst the piece of watch spring S screwed into the side bites into M, and prevents the key being turned the wrong way.

Renovating Bedsteads.—For renovating bedsteads where conveniences for enamelling or japanning goods are few, it would no doubt pay to lay down a japanning plant in a fairly large well-lighted workshop, with gas laid on for heating the drying and lacquering stoves. Double-cased steel stoves are more economical when continuously used, owing to the saving of the heat by radiation; they will heat up to 500° F. in a short time, and this heat is very easily maintained and regulated. The whole apparatus is complete with straight thermometer, and can easily be taken to pieces. Thoroughly clean the parts to be enamelled by emery bobs, sandpaper, or emery-cloth. Then give the surface a thin coating of tar spirit by rubbing over with a rag, drying off for fifteen or twenty minutes at 350° F. to 400° F. in the stove. Next, the enamel must be spread very evenly over the work by a camel-hair brush, and stoved at 250° F. to 300° F. A second coat may now be given, following the same procedure. Lastly, apply with a brush a better black enamel, and afterwards stove at 350° F. to 380° F. The article is now ready for polishing. This is done by well rubbing with cloth or felt, using finely powdered pumice-stone or tripoli. When the operation is nearly finished, rub on a little oil, and when the article is sufficiently bright, rub with oil alone to remove any dust that may have settled on it. Dry off with a soft cotton or silk duster to remove any dust, grit, etc. A small lacquering stove, specially fitted for the work, should be obtained. To renovate the brass part, it must be taken to pieces, and boiled for about twenty minutes in a strong solution of caustic soda to destroy any of the old lacquer; then, when dry, dip in nitric acid to produce a bright colour, and prepare for lacquering. The parts must be gently warmed, and the surface thoroughly covered with a layer of lacquer by a camel-hair brush, great care being exercised that the surface is not gone over twice to streak it. Leave the article on the stove to dry, and when all is finished, put it together and screw up. Of course, any coloured enamel might be used instead of black, as the procedure is the same for all colours.

Renovating Veneer on Piano.—In a piano left in a damp place glue may perish and veneer buckle up. In such places, work thin hot freshly made glue underneath by means of a thin bladed table-knife which has been warmed by first dipping in hot water; then press the veneer well home again by means of a warm flat-iron. Cracks, fissures, or broken portions may be made good by a mixture of shellac and resin melted in equal portions, and with a trace of dry pigment added to make the preparation match the colour of the wood. It can be melted in a ladle or tin, and the mixture may be pressed where required by a chip of wood. Clean off level, wipe over with raw linseed oil, and repolish.

Refixing Drumhead.—Here is explained how to refix a drumhead which has got on the cross. First of all, the head must be removed from the flesh hoop by soaking in cold water till found quite pliable. Previous to removing the head, observe how it was lapped round the hoop, as a guide for getting it on again. Before refixing, the head should be cleaned with a flannel and a little soap. Whilst still wet, place it face downwards on a clean table or bench, and lay on the flesh hoop so that the margin for lapping is equal all round. Divide the circumference into four, marking the points with a pencil dot, and commence the lapping at one of the points by tucking in the skin as it was before, and do the same with the opposite point. When these four points are worked in, again take the midway points, and proceed as before, never working two points on one side, but always taking the opposite point, and so on till the skin is on all round. Care must be taken that the head shall lie without wrinkles, or shall not draw the hoop out of shape. For the first few laps the fingers can be used, but afterwards a curved flat-ended tool, similar in shape to the handle of a pair of pliers, but much more curved at the end, will be found necessary. After lapping, and whilst still damp, place the head in position on the shell of the drum, fix the hoops, and only moderately tighten by the braces, and when dry tighten to the required pitch. The services of an assistant whilst fixing the skin will be invaluable.

Dinged Brickwork.—There are two kinds of dinging; one is axing old bricks to look like new, and the other is rubbing over the walls, new or old, with a piece of coloured brick in order to give the same general tint throughout. The latter method is generally adopted before tuck pointing in order to hide the original mortar.

Rendering Bone and Horn Transparent. — The opacity of bone is due to the presence of phosphate of lime, which it contains to the extent of 60 or 70 per cent. The lime can be removed by treating with dilute hydrochloric acid, but all that is left is the gelatine, the bone being destroyed; hence, for all practical purposes the opacity of bone cannot be removed. There is no method of removing the opacity from white horn, but treating with hydrochloric acid might be tried.

Convertible Mailcart.—Fig. 1 shows a convertible mailcart with a bassinette shaped body, Fig. 2 illustrating the panels A, rockers, and seats. In Fig. 3 D is a hinge, Fig. 4 being a side view of the plate G and showing a slot E, which fixes the handles in any position by a

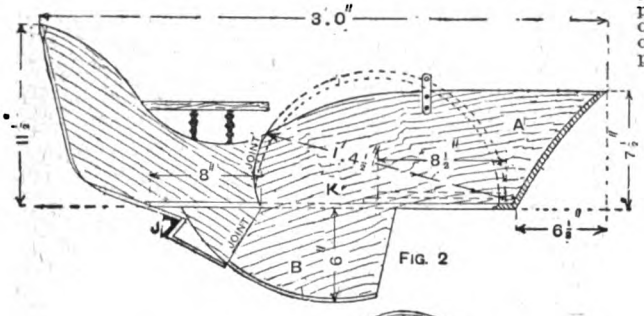


FIG. 2

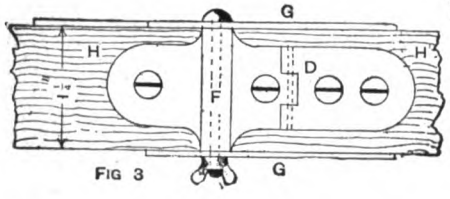


FIG 3

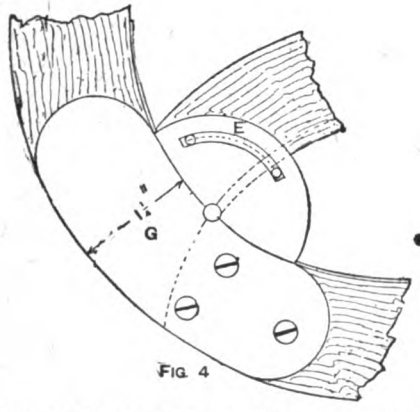
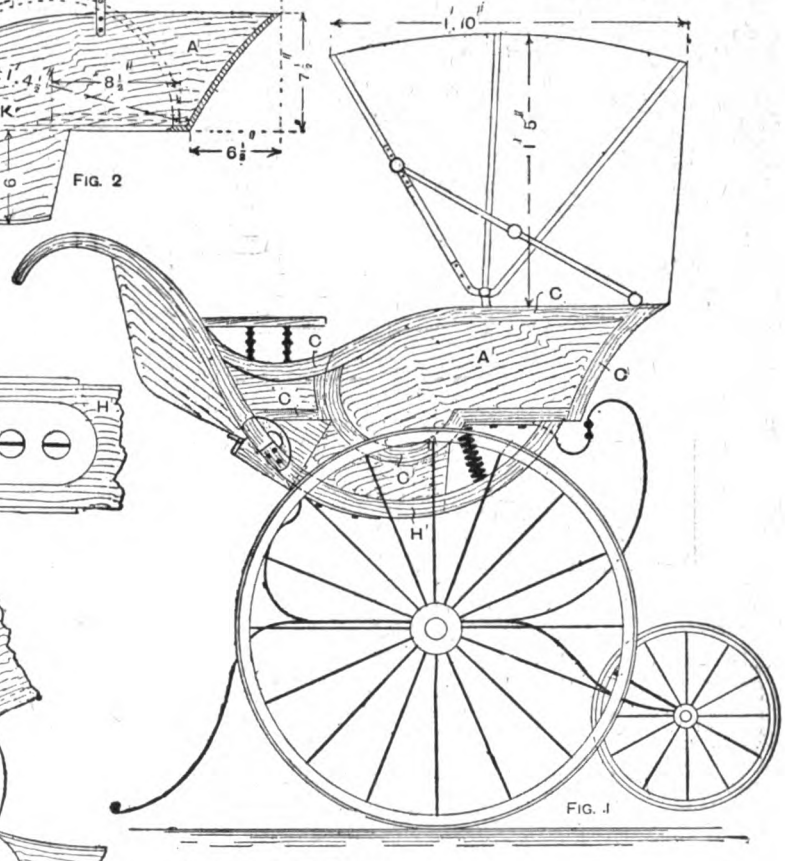


FIG 4

bolt similar to F (Fig. 3). In making the body, work to a full-size drawing of the complete mailcart, and order the wheels, axles, springs, and other parts, which can be obtained. If the cart is to be varnished in the wood, American walnut looks well, with white ash mouldings C (Fig. 1), and if it is to be painted white wood would do. The rockers B (Fig. 2) are screwed inside the panels, ¾ in. on, and boxed out on the bottom to take the bottom boards, and at the back end to take a ¼-in. panel. The body panel, front panel, and bottom part and footboard are boxed out ⅜ in. deep, and the seats are convertible into a cot by the use of the centre-board K, Fig. 2. When not used as a cot this is swung over on the back. J, Fig. 2, is a hinge, and the front seat can be dropped and the child can sit on the fixed front seat. The back part of the body is 1 ft. 4 in. wide on the bottom, and 1 ft. 5½ in. outside the top of the panel. The handles H (Figs. 1 and 3) are 1¼ in. square, and are screwed on to the rockers from the inside. The wheels are 2 ft. 1 in. and 1 ft. high.

Restoring Colour of a Mahogany Table.—The dirt and old furniture paste can be removed from a mahogany table by well rubbing with paraffin or benzoline. The scratches, if deep, will require to be drawn up by pressing a strip of warm iron along their track, first wetting the place with cold water; or, better still, place a wet piece of rag over the bruise and press the hot iron along, the steam thus generated often drawing up the bruised surface level. If this fails, however, it may be necessary to scrape the surrounding surface till it is level with the damaged portion, and if the scratches are not deep it will ofttimes be sufficient if the surface of the polish only is removed; do this with No. 1 glass-paper, first wiping over its face with linseed

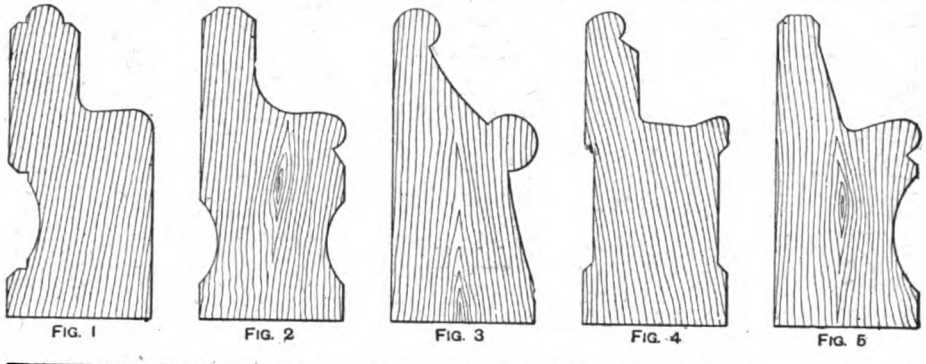


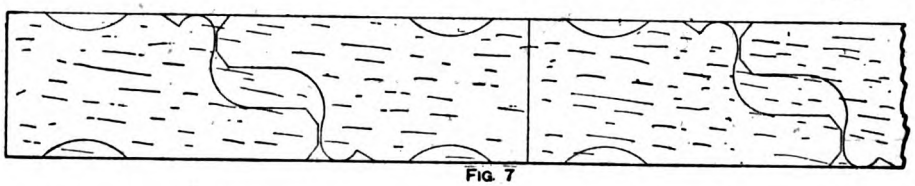
Convertible Mailcart.

oil, finishing with finer paper. The faded portions will require colouring up, unless the faded polish is removed by sprinkling it with methylated spirit and rubbing whilst still wet with glasspaper. Coloured polish will probably be necessary to get an even colour.

Parchment Paper.—This is made by running finished paper through sulphuric acid slightly diluted with water, and neutralising the excess of acid by an alkaline bath or water. The acid could not be used in the beating engines, and if it were applied to the pulp, the operation would have to be done in an earthenware or lead-lined tank and the pulp thoroughly washed before it was brought on to the felts. Any treatment of the pulp would, however, not have the same effect as that produced on the paper, the action of the acid causing the solution of a certain portion of the surface cellulose and its deposition on the exterior of the paper as a continuous and, to a certain extent, impervious film.

Designs for Church Seats.—In most places of worship the old-fashioned box seat is superseded by the open seat. These seats are, as a rule, made of pitchpine. As pitchpine makes a very cold seat, the seat-board may with advantage be of yellow pine. Figs. 1 to 6 show designs of ends suitable for such seats. The height of the seat-ends varies a little, but is usually about 3ft. 3in., the width being 18in., the thickness 1¼in., and the height 2ft. 2in. at the arm level. When a number of ends are required, good clean planks, 18in. by 1¼in., are selected. A pattern of a seat-end is placed on the plank, and the pattern lined round with lead pencil, after which the ends are cut to line usually with a band-saw. If the proper method is not adopted when lining these





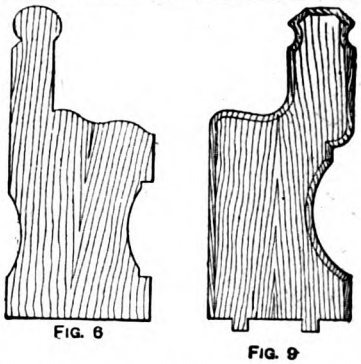
Designs for Church Seats.

ends, much timber will be wasted. Fig. 7 shows a correct method of lining. From Fig. 8, which shows a wrong method, it will be noticed that in a plank long enough for four or more ends, for every four ends lined there will be a waste of about two-thirds the length of an end, and for every six ends, waste equal to one end in the length of the plank. In the figure, X denotes waste. Fig. 9 shows a prepared seat-end, which is chamfered. If the band-sawing has been done to line with a saw in good condition, very little cleaning up will be required after the chamfer has been made. The tenons at the bottom of the seat-ends fit snugly into mortises made in the floor.

Purifying Sweet Oil.—The simplest method of cleaning sweet oil that is very dirty will be to heat the oil to about 300° F. and run it through a very fine strainer or a piece of muslin. It should then be placed aside for about fourteen days, when the clear top oil may be ladled off. There are several other methods of cleaning the oil, but they would require costly apparatus. If the oil is required very pale or what is known as refined, the cheapest method will be to send it to an oil refinery and have it chemically treated. The process described above would sufficiently refine the oil for ordinary purposes, lubricating, etc.

Cleaning Soundboard of Unpolished Mandoline.—The usual method of cleaning the soundboard of an unpolished mandoline is to remove the upper surface by means of a cabinetmaker's steel scraper and finish off with two grades of glasspaper. If a scraper is not at hand, cold water and pumicestone soap or Monkey brand soap is advised; this should remove the dirt. When the surface is quite dry, smooth down with No. 0 glasspaper. If the instrument is inlaid with pearl and black around the soundhole, this portion may be similarly treated. If, however, it is inlaid with celluloid in the form of a shield, care must be taken that the polish is not removed with the glasspaper. The wood can also be rendered whiter if, when glasspaper is being used, the surface is rubbed with chalk or whiting so that the operation of rubbing may at the same time press some of the chalk or whiting into the wood pores; such an effect is not very permanent, of course.

Colouring Illumination Lamps.—For colouring plain illumination lamps, first cleanse them with a strong solution of potash, well rinse in clean water,



thoroughly dry, and place in a warm room for a few hours before colouring so as to warm them sufficiently to prevent chilling. Obtain small quantities of Crane's cold lacquer of the colours required, and either dip the lamps and drain or lay the lacquer on with a camel-hair brush, the latter method being the better if only a few dozen lamps are to be coloured. Then hang them up to dry in a warm room. Common tumblers will answer the purpose of the lamps. They only need lacquering two-thirds up from the bottom, and about a tablespoonful of water should be put in when using to prevent damage to the tumbler. The lacquer can be removed with strong soda water. Price's special bucket lamp candles may be used on account of their cleanliness. Guttering candles will make the lamps very messy.

Screen Making.—The only method of hanging screens without metallic hinges is to use linen webbing, as in a clothes-horse; or for small pulp-board fire-screens a piece of tough linen, glued lengthways of the join, will suffice. To cover screens properly, practice is necessary. Hessians, canvas, and flax sheetings require well damping before mounting; leather cloths and other enamel-faced goods must be well warmed to prevent cracking. Always commence tacking in the centre, and work to the corners. Any wrinkles in hessians, canvas, and flax sheetings can generally be shrunk out by damping the back and ironing with a hot smoothing-iron; this will not apply to leather cloths, for which there is no remedy.

Sitting-room Chair.—Fig. 1 shows in part elevation a form of chair known as a ladder-back. The joints of the chair should be made with stub-tenons and mortises. The back is framed up to 3 ft. high, 1 ft. 6 in. wide at the top, and 1 ft. 2½ in. at the bottom. The front is 1 ft. 4 in. high by 1 ft. 6 in. wide over all, the total width of the seat from the front to the back being 1 ft. 4 in. A loose seat (see Fig. 2) is framed from 2-in. by ½-in. pine, and webbed on the top; the holes B fit on to

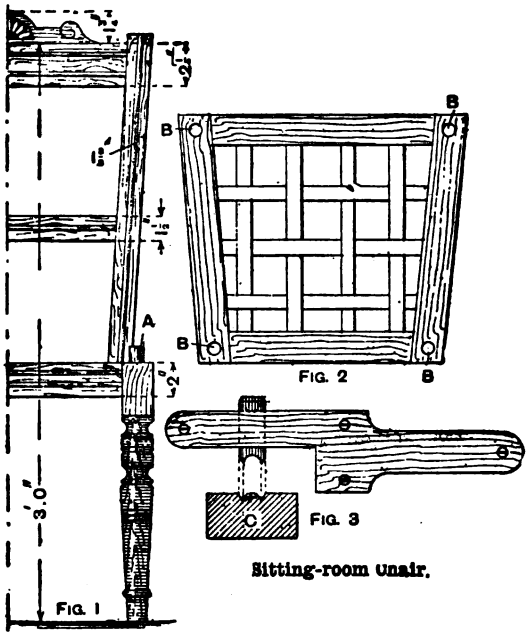


FIG. 2 FIG. 3

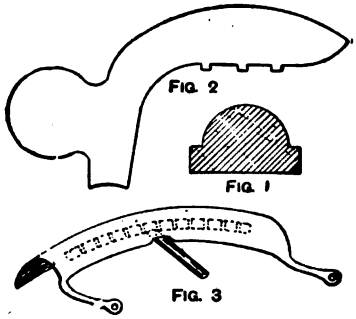
FIG. 1

Sitting-room Chair.

tenons A (Fig. 1) in the top of the knee and prevent the seat moving. In making, the back would be framed up complete, then the front, and the two parts connected by the side rails, the seat frame being made last. Beech wood is excellent for chairs, being very clean and bright in grain, but is more expensive than birch; the latter wood is used in immense quantities for chair-making. In the shops the beading would be done on a spindle machine; a hand home-made tool for beading is shown in Fig. 3, being simply two pieces of hardwood screwed together, the cutter being a thin piece of steel filed to shape and placed between the two pieces of wood; the fence keeps the cutter in a true working line. A profile of the bead is shown at C (Fig. 3). Shopmade handbeaders with iron stocks can be purchased fairly cheaply.

Enlarging Negative by Expansion.—Below is explained how to enlarge a negative by expanding the film. It is necessary in the first place to make up a 5-per-cent. solution of hydrofluoric acid; this is disagreeable stuff to have about, so that a 10-per-cent. solution of hydrochloric acid, which, however, is uncertain in its action, may be used instead. Citric acid, which is sometimes recommended, is likewise uncertain. Hydrofluoric acid, as well as its solution, owing to its destructive action on glass, must be kept in rubber bottles. This solution forms the stripping bath. Immerse the negative for a few minutes in plain water to ensure even wetting, and then transfer to the stripping bath. After a few moments' immersion the film should begin to show signs of frilling. Now very carefully draw the ball of the first finger lightly across the edge of the plate; this will effectually loosen the film, and it may then, with the same light motion, be rolled back off the glass. Do not remove the film all from one side, but treat each edge alternately until the film is completely detached. Now carefully lift the glass, together with the film floating upon it, out of the solution, and as carefully lower again into a dish of clean water at least double the size of the film. When the film is below the surface of the water, the glass may be removed, and its place supplied by a sheet of glass about twice the size, coated with gelatine. If a gelatine solution is not at hand, an unexposed dry plate, from which the unaltered silver has been fixed out, may be used. When the film has fully expanded (which will depend upon the gelatine, but is generally nearly double the original size) lift the film and glass out together, and stand up to dry. All the operations must be carried out very slowly and carefully, or the film, which, of course, is very thin and is extremely tender when wet, may be broken. Air bubbles, which are liable to get into the solution or between the glass and the film, must be carefully removed.

Re-rubbering Pneumatic Tyres.—In re-rubbering pneumatic tyres, first coat both sides of the fabric with solution. Do this by passing the fabric (which is wide enough for the circumference of the tyres) through rolls which are slightly heated, thus ensuring an even coating. Where this cannot be done, thin down the solution with benzoline for the first coat, so that it will soak into the fabric. The second coat should be as thick as treacle, and must be brushed evenly with a stiff brush. The strips are cut on the bias at an angle of about 45°. Two strips are used; these, when solu-



Re-rubbering Pneumatic Tyres.

tioned together, have the threads in the top strip running across the threads in the bottom strip. When the strips have been rolled well together the ends are joined, one end of the top overlapping the bottom, and the other end of the bottom overlapping the top strip. The tyre is made up on a block of the diameter and shape of the tyre. A section of the block is shown in Fig. 1. On each side of the block running round the circumference is a bead or ledge, on which the wires are placed. The fabric is put over the block and the wires over the fabric on to the beads or ledges. The fabric is put straight, solutioned, and turned over the wires each side and rolled down. When the fabric is dry, it is put over a dummy tyre (an air tube enclosed in a canvas case) and blown up on an ordinary wheel. The wheel is fixed on the bench between two upright strips, slotted to take the spindle passed through the hub. The rubber is put on after being cleaned with benzoline and coated with solution. To get the lines or corrugations straight a guide (Fig. 2) is used. This is made to fit on the edge of the rim and into the corrugations. After the rubber has been well rolled down the edges are trimmed off and the inside of the tyre is rubbed over with French chalk. When the tyres are of ordinary canvas they can be made without the block. If the tyre is to be 3 in. wide, cut the canvas 8 in. wide. Solution one side only. With blue lead draw lines 3½ in. apart and 2½ in. from each edge. On these lines the canvas will be folded over the wires. The canvas will overlap 1 in., giving three thicknesses for the tread. Solution and roll down the overlapping portion, and solution on this side for the rubber. The canvas can then be blown up on a wheel. A handy tool for stripping off old rubbers can be made as follows. Bend a piece of sheet iron, about No. 12 gauge, as shown in Fig. 3. A gas tube is fixed under the plate with small holes drilled in it at intervals; this is connected to the gas bracket by a rubber tube. The tyre is placed over the hot plate, when the rubber will come off easily.

Selecting and Turning Watch Cylinder.—In selecting a watch cylinder one must be obtained that is longer than the old one now discarded, and its diameter must be such that the wheel teeth go inside it and have a little shake; also, the cylinder must go between two wheel teeth with a little shake. The freedom of a tooth in the cylinder is the "inside shake"; the freedom of the cylinder between two teeth is the "outside shake." These should be approximately equal. To measure the height of the passage, remove the under chariot, and in its place screw a thin piece of brass having a hole, where the cylinder comes, half the size of the cylinder body. Turn the lower part of the cylinder away until, when it stands on this brass piece, the passage is correct. Then turn the bottom pivot. When turned and rounded up and stood in its jewel hole, sight the height of the balance seat just above the 'scape cock level. The total height of the cylinder is measured over the outsides of the jewel holes (with endstones removed) with a douzième gauge. For further particulars of cylinder turning, see Series II, p. 232.

Home-made Plough Plane.—The drawings show a very handy form of plough plane that can be easily made. The stock may be of any wood, but hard wood for preference, the lower part being rebated so as to leave a projection a little smaller than the plough iron, as shown at B (Figs. 2 and 3), or, as is shown in Fig. 1, a chisel will answer the purpose; then by making a wedge-shaped slot, and gouging a hole out as illustrated for the escape of shavings, a wedge A (Fig. 3) can be made to the required shape; this will fasten the chisel into the stock. The

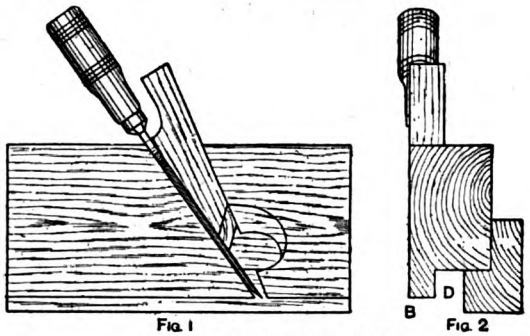


Fig. 1 Fig. 2

Home-made Plough Plane.

fence (Figs. 2 and 3) is made of another piece of hard wood, which is rebated so as to leave the required distance for working from the side of the material (marked D, Fig. 2). It can be secured to the stock by a couple of screws. The disadvantage of this plane is that the fence would require to have a deeper or shallower rebate for each new job, but the alterations could be made without much trouble.

Hardening Gold and Silver Wire.—Gold and silver are hardened by compression, and a suitable way of applying this is by drawing the wire through a draw plate, and reducing its size a little by burnishing it with a steel burnisher and heavy pressure (if the wire is very thin), by twisting it, or by hammering. The method employed depends entirely on the work in hand; thus, a brooch pin that has been soldered at the joint is generally given a twist, a scarf pin soldered in the centre is hammered and burnished, and so on, using the most readily applied method.

Testing Milk.—The analysis of a sample of milk is not a simple matter—in fact, it can be done only by one experienced in the work. It is, however, possible to test milk by simple methods to determine whether it is grossly adulterated or not. To do this it will be necessary to procure a hydrometer and a cream tube, and the simplest form of hydrometer consists of a bulb of glass with also a glass stem; it is loaded with mercury or shot, and the stem is graduated. For examining milk the kind known as a "urineometer" should be procured. If placed in a tube of genuine milk, the hydrometer will sink to the mark 1030 to 1032; in watered milk to a mark below 1030; and in skimmed milk it will sink to 1032 to 1035. The cream tube consists of a glass tube about 6 in. long and 1 in. in diameter, with several graduations near the open end; if the tube is filled to the upper mark and left to stand overnight, the cream will have risen in the morning and may be read off. If genuine milk, 8 to 12 or even more per cent. of cream will have risen; if skimmed milk, less than 8. As a rule, each division on the scale represents 1 per cent. of cream. It is necessary to use some circumspection in judging the results of these simple tests, because a milk with plenty of cream has a low gravity—*i.e.* a milk with 12 or 14 per cent. of cream may register only 1028 or 1029 on the hydrometer. Water can be removed from milk only by evaporation, and as for other impurities, with the exception of the occasional addition of preservatives, there are none; preservatives cannot be removed from milk.

Chimney Sweeping.—Personal experience is better than any description, and a person requiring an insight into the work should be present when a chimney is swept in the house he occupies. The brush is usually put up the chimney and length after length of the rod screwed on as the brush is pushed up. A cloth is fastened in front of the fireplace if the grate is in a living-room, the rod passing through a hole in the cloth. Chimneys that cannot be swept by rods are cleansed by another arrangement. A ball attached to a cord is dropped down the chimney; a brush is attached to the other end of the

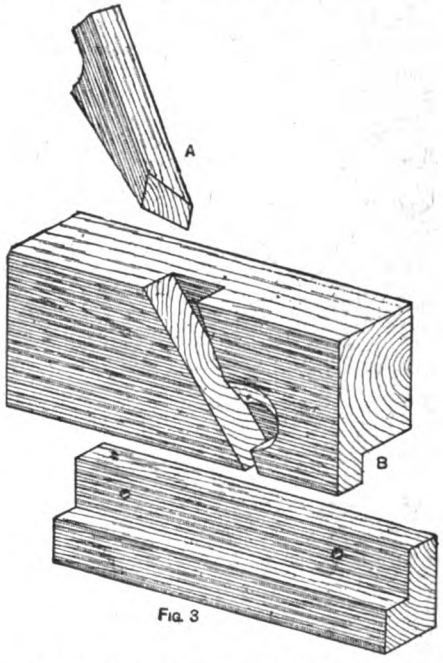


Fig. 3

cord, and the sweep, standing at the fireplace, seizes the cord and draws the brush downwards. Awkwardly constructed chimneys are provided with external soot-doors through which the rods or the ball can be inserted. Huge farmhouse chimneys are commonly cleaned with a holly bush, which is drawn up and down the chimney as often as required. Tools can generally be obtained from plumbers or from builders' merchants. Soot generally finds a ready market among gardeners, farmers, etc., who use it on the land.

Bright Silver-plating.—To get a bright deposit from ordinary silver-plating solution, put 1 qt. of an old silver solution into a ½ gal. Winchester bottle. Add to this 2 fluid ounces of carbon bisulphide, and shake well together; then fill up the bottle with a strong solution of potassium cyanide. Keep in a cool dark place. Add a small quantity of this to the ordinary plating bath, as required, well stirring the whole each time. This should only be used for special work, and in an old solution, as it ruins the bath for all subsequent ordinary silver-plating. A chocolate colour on the anode denotes a deficiency in free cyanide of potassium. The remedy is to add cyanide until the anode works clean.

Boot Dubbing.—For a good dubbing boil together 2 lb. of black resin, 1 lb. of tallow, and 1 gal. of crude or train oil. Another recipe consists of 1 gal. of boiled linseed oil, 4 lb. of mutton suet, 3 lb. of yellow beeswax, and 2 lb. of common resin; melt all the ingredients together. Warm the leather previous to well rubbing in the dubbing. The latter recipe will render shoes waterproof, and can be applied to soles as well as uppers.

Sanded and Painted Wood.—In the case of posts which are to be painted and then coated with fine sand, the process of accomplishing this is as follows. Paint the posts in the ordinary manner, and while the paint is still wet throw handfuls of clean, sharp, dry sand at the posts until the whole of the paint is covered with sand. The sand should first be dried in an oven or over a stove. If the desired effect is not produced by the first coat of sand, a second coat of paint may be applied over the sand after the first coat has properly dried, and then followed with a second application of sand.

Child's Combined Running Stool and Barrow.—The combined running stool and wheelbarrow illustrated by Fig. 1 may be used for teaching a young child to walk. The leading dimensions are figured on the side and end elevations, Figs. 2 and 3, whilst the following are particulars of the construction. The shafts and handles are 1½ in. square, the legs 1½ in. in diameter, and the rails A, B, and C (Fig. 1) ¾ in. in diameter; they should be made of ash, the body support D, ¼ in. thick finished, being made of any hard wood. The edges of the hole should be rounded off, and the ends of the support fit into grooves made in the handles, the parts being screwed together. Any kind of wood will be suitable for the barrow, even deal; the bottom end and sides are all ¼ in. thick, and the last are 8 in. wide. The wheels (¾ in. by 6 in.) and the spindle (1½ in. square) are made of hard wood. The most suitable joint between the legs and handles at E (Fig. 2) will be the mortise and tenon, and the three rails A, B, and C fit holes bored in the legs and shafts. A groove formed in each of the sides receives the front, and ordinary castors can be used for the bottom of the legs, but those of the ball pattern will be more suitable, as they readily move in any direction. Having cut out the spindle, this being of a square section so that the wheels can be fitted on to it better, its ends can be connected to the shafts by means of a couple of 4-in. round-headed screws, these of course working freely in the holes of the shafts, but fitting tightly into the ends of the spindle. All the parts that come in contact with the child's hands or body are rounded.

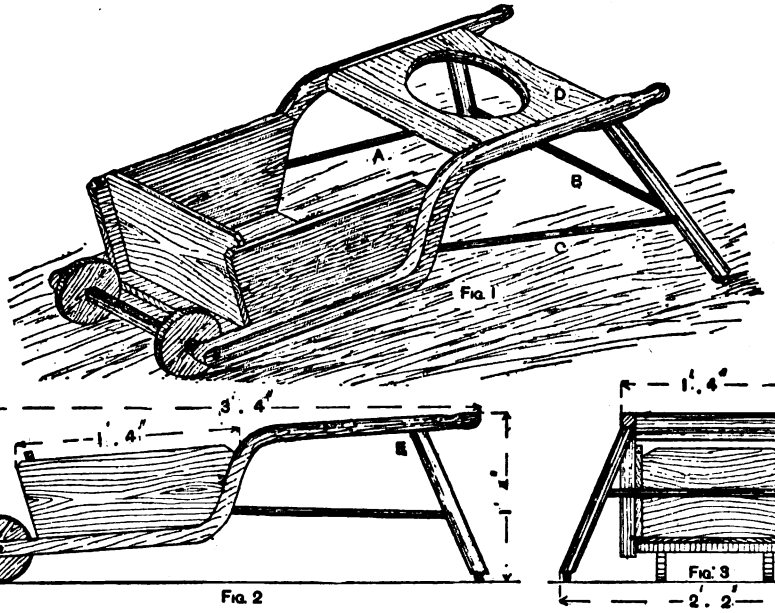


Fig. 1

Fig. 2

Fig. 3

Child's Combined Running Stool and Barrow.

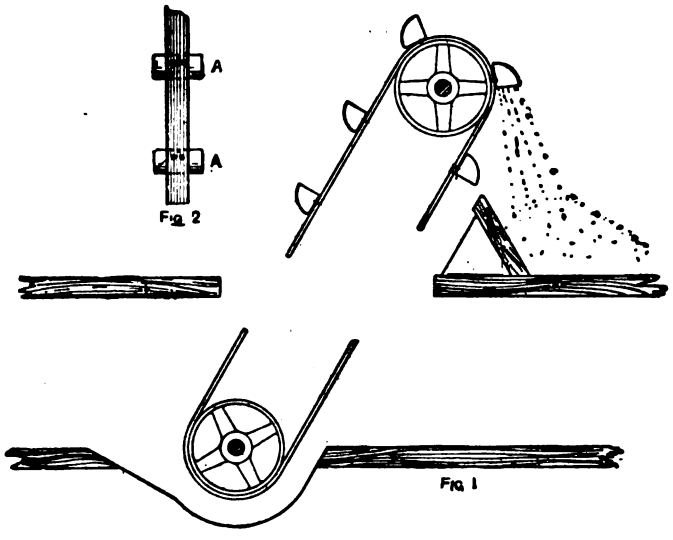
Buildings in Photograph out of Perpendicular.—If two parallel lines (or towers) are photographed when placed at different distances from the camera, it will be found that the lines are at different distances from each other on the focussing screen, the space between the lines being regulated by the distance behind the lens that the rays have to travel, which distance is directly proportional to the distance between the lens and the object. By a natural law of perspective, therefore, if an object is above the line of sight, the rays of light have farther to travel, and the object looks smaller, or the parallel lines come closer together. If a book is held well up above the head and looked up at, the sides of the book will appear to run together towards the top. Bearing in mind, however, that the size of the object is governed also by the distance the rays travel before reaching the focussing screen, the necessary correction can be made by swinging in the back of the camera at the top, so as to bring the plate vertical or parallel with the object. Information on the use of the swing-back adjustment is given in Series I., p. 338.

Acetylene Generator for Optical Lantern.—In using an acetylene generator with an optical lantern the danger to be guarded against most is that of allowing the gas to escape where there is a naked light, or of bringing a light to the place. It must be borne in mind that, prior to the generator being charged, it is filled with air, and therefore, when the gas is first made, the apparatus becomes charged with mixed gas and air, which is explosive. A fair proportion of the first gas that makes the holder fill should be discharged into the open air to waste. The next thing is to practise charging the apparatus, so that it will not make too much gas at the start (it should not do so afterwards). If too much is made, it will blow out through the water-seal into the room and will smell. If there is risk of this, the apparatus should be kept about 15 ft. from the nearest light (horizontal distance). It is probable that at the worst the generator would not discharge more than ½ ft. of gas per hour in this manner, and this volume would be dispersed and non-explosive before it reached a light 15 ft. away. But the escape will not occur if the working of the generator is mastered.

Bookbinders' Varnish.—Ordinary shellac varnish is quite good enough for all purposes for which the bookbinder uses varnish. To make it, put a pennyworth of shellac into a bottle, and pour over it 1 pt. of methylated spirit of wine (both to be obtained from the druggist), and cork well and shake occasionally; the shellac will soon dissolve. It may be strained before use into another bottle. If it is too thin, add more lac; if too thick, thin with spirit. There is nothing to be gained by using a high-priced varnish, or one with a number of different gums or lacs, for the object of varnishing is to give certain leathers a shiny appearance, and the above preparation will do as well as any other. The following recipe is supposed to be the best known. Put into a vessel 6 oz. of mastic in drops, 3 oz. of sandarach finely powdered, 4 oz. of coarsely broken glass, and 32 oz. (1½ pt.) of spirit of wine; place the vessel upon straw in another vessel filled with cold water, put it on the fire and let it boil, stirring with a stick. When the whole appears well mixed, put in 3 oz. of turpentine and boil for another half-hour, then take it off the fire and stir until it cools. Next day filter it through fine cotton and cork well up in a bottle.

Naphtha Varnish.—Shellac will readily dissolve in wood naphtha, but the solution does not give a very good varnish. Other gums are generally added to impart brightness and elasticity, and ofttimes resin, which gives brightness, is added in excessive quantities because it is cheap. If the varnish is to be used for a quick finish of woodwork the following recipe will be suitable: Wood naphtha 1 gal., shellac 2 lb., resin 8 oz., and gum sandarach 8 oz. Crush the gums, and dissolve in a stone or glass jar, frequently stirring to prevent the gums massing together Strain through muslin. Apply with a camel-hair brush. Keep the bottle tightly corked when not in use.

Grain Elevator.—To lift 30 bushels of oats an hour to a height of 9 ft. would require only about 0·008 horse-power, or about one-eighth of what a single man is capable of lifting in the time if someone else fills for him. A builder's rubbish wheel hung overhead with a 2-in. rope and a canvas-lined cane basket suit the case; but, of course, if an elevator is desired, it may be adopted—say a 1½-in. leather belt with block tin cups 3 in. wide, 1½ in. broad, and 1½ in. deep, with flat backs and curved fronts, 6 in. from centre to centre, fixed to a belt with two copper rivets, and working over a 6-in. belt pulley top and bottom with 1-in. shafts. The bottom pulley would



Grain Elevator.

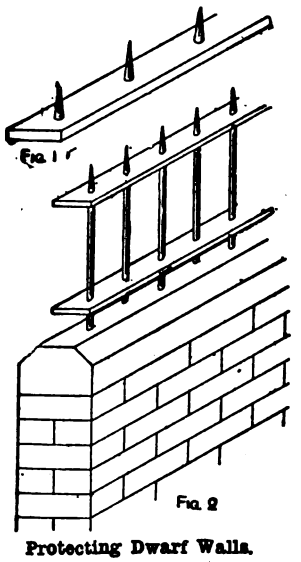
run in a semicircular race of sheet zinc on the ground floor (see Fig. 1), so that the grain could be fed to the cups, about 105 of them carrying a bushel. For 30 bushels an hour, this would mean a belt speed of, say, 30 ft. per minute, which, with 6-in. pulleys, would be about twenty revolutions a minute, but it would work better if it went faster. Fig. 2 shows a back view of the belt with the cups A fixed. If something cheaper is wanted, upholsterers' webbing, and smaller tin cups, running over wooden wheels, could be employed. A good business grain elevator would be required to lift, say, 3,000 bushels an hour to a height of from 60 ft. to 70 ft., and this would require from 6 to 7 horse-power.

Oak Stain.—A simple method of preparing an oak stain is to mix 1 oz. of black japan in 1 pt. of turpentine; apply one or two coats according to the depth of colour required. Another stain may be made by dissolving 1 lb. of glue-size in 1 qt. of boiling water, adding a few ounces of dry burnt umber and ochre to meet requirements. Apply hot. Both the above stains should be allowed to dry, and should then be finished off with two coats of hard oak varnish.

Curling Pond.—Below are some hints on constructing a curling pond, which is to be about 50 yd. long by 13 yd. wide. The site should first be made perfectly level, and a clay subsoil will be a distinct advantage. The site, after it has been levelled, should be covered with rough concrete about 6 in. thick, made in the proportion of 4 parts broken stone, 2 parts crushed stone or sand, and 1 part of best Portland cement. To ensure getting an even thickness of concrete, pegs should be driven into the ground at frequent intervals and allowed to project 6 in. from the surface; the concrete is then laid to the level of the top of the pegs. The pegs are withdrawn after the concrete has set, and the whole surface is then grouted with cement and sand in the proportion of 1½ to 1; the upper surface should then be covered with fine concrete, formed of 1½ parts of sand to 1 part of cement. A floor of this kind, however, is very likely to crack with the heat of the summer, and instead of an upper surface of fine concrete the better plan will be to use best natural asphalt. A curb in concrete or stone should be laid round the edge of the floor so as to retain the water, and a drain provided with a valve should be constructed in order that the water may be drawn off if necessary.

Chocolate-coloured Paint for Exterior Use.—To prepare the priming coat for outside woodwork, mix together 12 lb. of genuine white-lead, 2 lb. of black paint, 2 lb. of patent driers, 1½ pt. of boiled linseed oil, and ½ pt. of turpentine. For the second coat, of chocolate colour, mix together 14 lb. of Indian red paint, 1 lb. of black paint, and 2 lb. of patent driers, and thin down to the required consistency with 1 pt. of boiled oil, ½ pt. of turpentine, and ½ pt. of oak varnish.

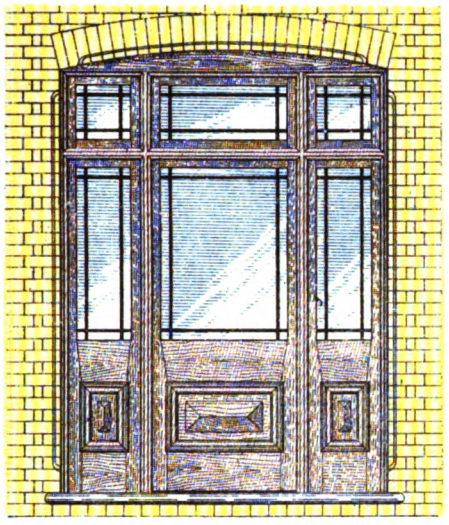
Protecting Dwarf Walls.—The only practicable method of making dwarf walls too uncomfortable for idlers to sit upon is to fix on the top of the walls a wrought-iron bar, say 2½ in. by ½ in., with spikes at 5-in. centres, as shown in Fig. 1; a more expensive railing, with two horizontal bars, is shown in Fig. 2. Barbed wire, within 6 ft. of a highway, is illegal, and broken bottles are often impracticable.



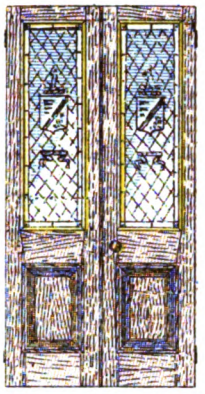
Protecting Dwarf Walls.

Brunswick Blacks.—The drying agents used in preparing brunswick blacks and black japans are litharge, red-lead, and black oxide of manganese, combined with asphaltum and pitch. Isinglass, owing to its insolubility in oils, etc., is unsuitable. Gum kowrie, animi, and copal are used for the finest qualities of black japan, but rarely in the preparation of brunswick blacks. The following are formulæ for brunswick blacks. (1) For best quality, 8 lb. asphaltum, 1 gal. linseed oil, ½ lb. flake litharge, ½ lb. black oxide of manganese, and 4 gal. American turpentine. (2) For a cheap quality, 4 lb. common asphaltum, 4 lb. bone pitch, ½ lb. lampblack, 1 gal. boiled oil, ½ lb. litharge, ½ lb. black oxide of manganese, and 3 gal. turpentine. Resin is sometimes used, but is liable to crack or shell off. The method of preparing these blacks is to place the asphaltum, pitch, and oil in a suitable iron pan and boil for two or three hours. Then sprinkle in steadily the drying agents, litharge, manganese, and lampblack, while constantly stirring, and boil for an hour or until the mixture turns stringy when worked between the fingers. Allow it to cool down to about 240° F., take well away from the fire, stir in the turpentine, pass through a strainer, and allow it to stand three or four days, when it is ready for use. Recipe No. 1 may be employed on all kinds of carriage ironwork, hollow-ware, etc., and recipe No. 2 is much used on all classes of ironwork, stoves, etc. Both of these varnishes dry hard in about three hours, and with a good gloss which is quite durable.

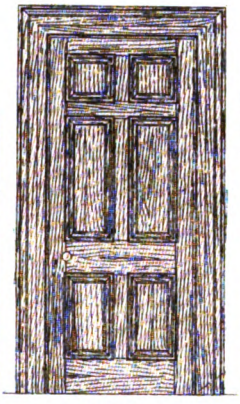
DOORS.



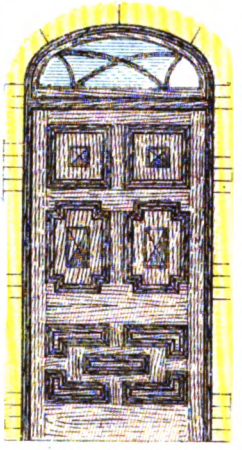
DOOR WITH SIDELIGHTS AND FANLIGHTS.



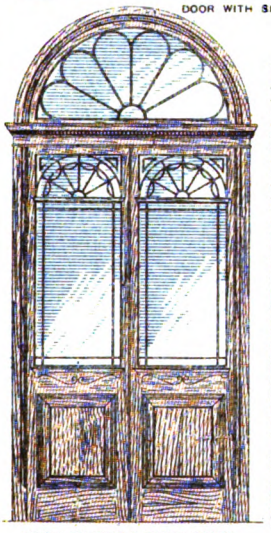
FOLDING DOORS.



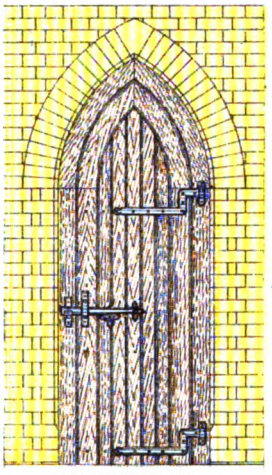
SIX-PANEL DOOR.



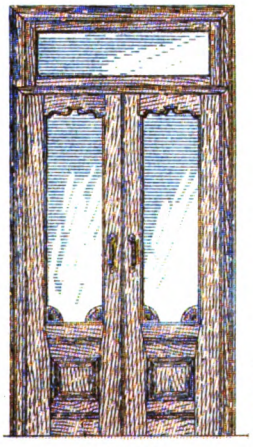
ELLIPTICAL-HEADED FRAME



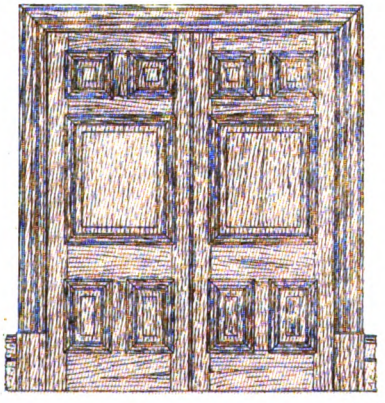
CIRCLE-ON-CIRCLE SWING DOORS.

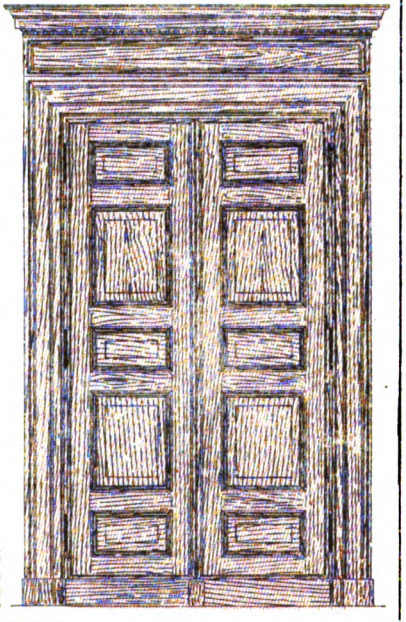


GOTHIC-HEADED DOOR.



LOBBY DOORS.

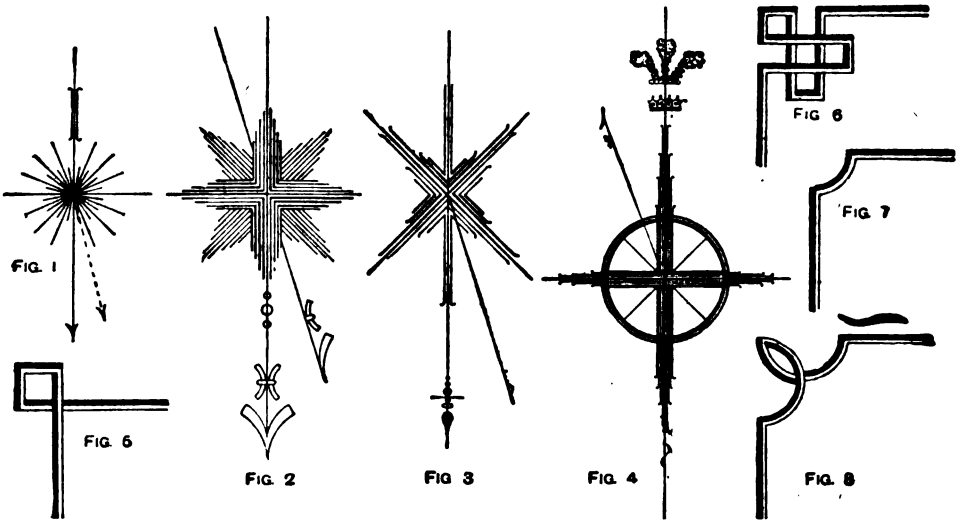




FOLDING DOORS.

Leeboard for Boat.—A very efficient contrivance to check leeway is the leeboard usually hung from the gunwale at the sides. It should be about one-fifth the length of the boat, and at its broadest part two-thirds its own length, and at its narrowest part one-third its own length. If the board is fixed to an open boat the gunwale should be strengthened at the point of attachment by a piece of timber worked inside at the back of the boat's timbers; for a boat 20 ft. long this should be at least 5 ft. 6 in. long, 6 in. deep, and 1½ in. thick. The board must be pivoted at its narrow end by a ¾-in. bolt, and its neck, which passes through the board, should be square, and a square iron plate with a square hole in it should be fitted on each side of the board through which the bolt will pass. The round part of the bolt will pass through the gunwale and strengthening piece. The bolt will be tightened by a thumb nut, and to prevent the latter working into the strengthening piece, it will be best to have an iron plate bent over the topstrake and down on the inside to the strengthening piece. The board should be made of 1-in. English wych (or witch) elm with three through bolts each ¾ in. in diameter. This elm is fine-grained, tough, and elastic, and is well suited to the purpose.

Map Corners and North Points.—Figs. 1 to 4 show some north points. Map corners, which may be made in either single or double lines, are shown by Figs. 5 to 8. If stencils are used, a stencil leaf may be placed in each corner and joined by straight lines.



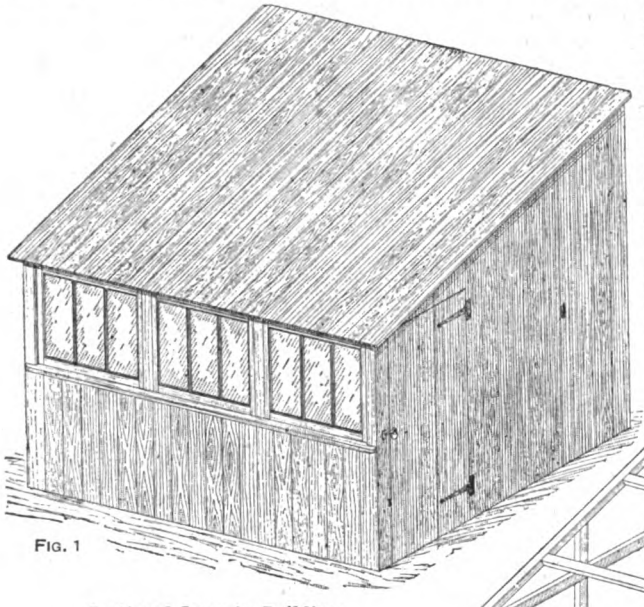
Map Corners and North Points.

Cleaning Aneroid Barometer.—When taking an aneroid barometer to pieces for the purpose of cleaning, first remove the pointer, which, like the hands of a clock, is merely pressed on its arbor. Then remove the dial. It will now be seen that to the mainspring (which, acting in opposition to the vacuum chamber, gives rise to the variations of the needle in the instrument) is attached the main lever and a system of smaller levers and springs. It will be necessary to remove these next. First release the regulator of the movement, which works between centres supported by the bent ends of a small base-plate. Next detach the fine steel rod which connects the regulator with the main lever. Then unscrew the main lever from the mainspring. The arbor which carries the regulator carries also a bent-up arm to which is attached a fine chain. Release this chain and remove the arbor by unscrewing the centre ends. Now unscrew the projecting arm from the pillar to which it is secured, and remove the thin brass plate which is screwed to the small brass pillars at the end of the projecting arm. By doing this the arbor which carries the hairspring and the chain can be removed. The base-plate of the movement can then be removed. Now take off the knife edge which fastens the mainspring to the upper part of the vacuum chamber, and then unscrew the iron carriage which supports the mainspring and which is fastened to the foundation plate. Finally, unscrew the vacuum chamber from its position on the foundation plate. Having thus taken the whole instrument to pieces and placed the parts separately and systematically to hand, it will be easy to see where they belong and to clean them consecutively. Place the rusted steel and iron parts in a basin filled with paraffin oil. Let them soak for a while, and then rub them free of rust. Brush the chain with rather a hard tooth-brush and examine each link to see that no material damage has been done. If the links are sound, well and good; if not, a new chain may be required. Similarly with the springs and the pointer. The latter is, of course, of aluminium, and will require gentle handling. When all the parts have been cleaned and dried, rub them over with clean tallow and, reversing operations, fix them again in their respective places. If when removing close observation has been made as to the relative positions of screws and levers, and the pieces are replaced as nearly as possible to their places previous to removal, much time and trouble may be saved in the matter of regulating the instrument. When the instrument has been put together and screwed into its case, it must be tested under an air pump to ascertain whether there is any alteration in its range—that is, in the number of inches indicated on the dial. If this test is unsatisfactory, another dial should be obtained and divided to suit. When this has been divided and engraved, and placed in position, the pointer is attached to the arbor. Then the portion of the scale to which it should point is ascertained by reference to the scale of a standard mercurial barometer. By a slight turn of the adjusting screw connected with the carriage which supports the mainspring, exact agreement is obtained. Finally, the aneroid must be tested under various pressures with a standard mercurial barometer. In testing, both instruments are placed in receivers connected by a tube and stopcock, thus virtually forming one chamber. When the compartments are simultaneously exhausted of air, if the scale of the aneroid has been rightly divided and the instrument works in accord with these divisions, the pressure in inches indicated will correspond, tenth for tenth, with the divisions on the mercurial scale as the mercury falls and rises. Lastly, it must be remembered that, however well the instrument may have stood all the tests, any form of aneroid will require occasional adjustment, which must be done as already directed by means of the adjusting screw and comparison with a standard mercurial barometer.

Stripping Films from Photographic Prints.—Ordinary P.O.P. has been squeegeed down and hot water poured on the back of the print till the paper blistered off, but the results are extremely uncertain and decidedly not worth the trouble. The cheaper and more expeditious method is to use transferrotype paper (sold by Kodak, Ltd.) or Novitas stripping P.O.P. The article that is to receive the picture is coated with gum: then the print (which has been printed very darkly) is placed in warm water together with a waxed sheet of paper. The soluble substratum of the print soon dissolves, and the gelatine film is liberated and may be floated on the waxed sheet, withdrawn, laid down on the prepared support, and smoothed into close contact. Some little trouble may be experienced in peeling if the surface is not flat. The pictures should be coated with copal varnish, and may then be washed when necessary.

Blackening Umbrella Cover.—The colour of an umbrella cover may be improved by sponging it first with a decoction made by boiling 6 oz. of logwood chips in 1 pt. of water, straining and making up to 1 pt., then sponging with a solution consisting of 2 oz. of copperas and 1 pt. of water; finally, after standing a few hours, sponge with clean water and dry while the umbrella is fully stretched open.

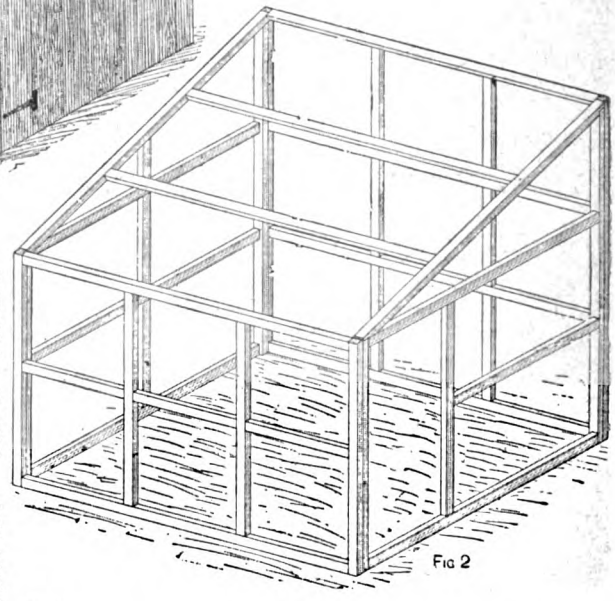
Sectional Lean-to Building.—Fig. 1 shows a sectional lean-to building 10 ft. long, 8 ft. wide, height at back 9 ft. 6 in., height at front 6 ft. 6 in. Fig. 2 shows the complete skeleton framework, the joints of which are all of a simple character, principally halving and lapping. On looking at Fig. 2 it will be seen that the front, ends, roof, and back form independent pieces of framing, to which the



Sectional Lean-to Building.

boarding (grooved and tongued matchboarding will be most suitable) would be nailed, then the two posts meeting at the angles would be secured together by two or three bolts and nuts, or long screws from the inside would do. The door would be hinged with T hinges, and the boards forming the roof covered with felt. The quantities of timber required, will be as follow. For framing, sashes, etc., 300 ft. run of 3-in. by 2-in.; 800 ft. of ½-in. matchboarding; about 21 sq. ft. of glass. If the building be placed against a wall sufficiently high a back would not be required.

Easy Method of Binding Parts of Periodicals.—The method of binding any book in the publishers' covers is simply the ordinary one of sewing, glueing, cutting, etc. But below is offered a suggestion for a method of joining together, and attaching to the case, numbers or parts of books or periodicals. When the volume is completed the publishers issue a cloth case or portfolio for binding, and for this it is usual to cut the edges of the book, but this may be dispensed with if desired. Place the case down on the table with the inside uppermost, and measure exactly the space of the back, or the hollow, as it is termed. Cut a piece of wood to fit the hollow, leaving ⅛ in. of the case over at the top and bottom. When making this measurement, if it is found that the book is longer than it must be, cut it down. The wooden back should be cut from stuff about ⅛ in. thick, and it should be rounded on one side. At the top and bottom of the flat side fit in flush little strips of sheet brass across the breadth. Get now some tinned copper wire, such as is used for electric bell work, but without the covering, and cut up as many pieces as there are parts in the book. The pieces should be about 1½ in. longer than the book. Straighten these pieces, and place one in the back or fold of each part of the book. To do this, open the part out flat and place the wire in the fold; close the part and hold it tight down on the table with one hand, and with the other bend, at right angles, the protruding parts of the wire, which should be equal at the top and bottom. When the parts have been arranged in proper sequence, bring the book to the edge of the table and place a heavy weight on it so that the hands may be free. Now place the wooden back close against the back of the book and bend the wires over this. Little notches should be cut in the brass and wood, in which the wires are to lie closely, and a soldering iron run across will keep the wires from coming loose. During this operation, the book can be handled more easily if tied tightly between two boards. Now the book may be glued and put into the case. Cut a strip of strong linen the same length as the book, and 2 in. broader than the wooden back. Glue the wooden back and place the linen on it, allowing 1 in. over at each side; pull this on tight and rub it down well to ensure it sticking. Now fit the book in the case, put it flat on the table, open the top cover, and place the weight on the book to prevent moving. Glue the piece of linen, remove the weight, and close the cover, and press where the linen is; lift up the cover about half way, replace the weight, and with the fingers pull the linen outwards, at the same time rubbing it on the cover so as to draw it tight and make it adhere well. Close the cover down, turn over the book, and repeat the operations on the other side. Now line the inside of the cover with white or coloured paper, as desired, and cut the lining so as to leave an equal margin all round. If it is found that the book requires cutting to fit the case properly, each part must be cut separately with a knife and traightedge before putting in the wires.

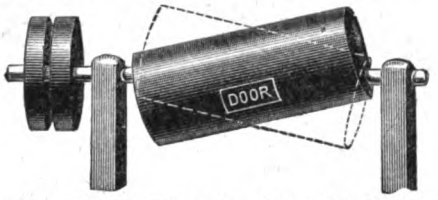


Nickel-plating Glass.—For nickel-plating glass, first give the glass a very thin layer of varnish or wax, then a coat of blacklead well brushed into the previous coat, so as to cover the whole evenly in every part. The glass, thus prepared, must then be suspended by slings of fine copper wire in an electrotyping bath (1 lb. of copper sulphate and 4 oz. of sulphuric acid in 1 gal. of rainwater), and copper deposited on the glass from this by electric current from a battery or a plating dynamo until the whole has been perfectly coated with copper. The glass must then be rinsed in water, and transferred at once to the nickel-plating bath, where it receives the requisite coat of nickel. It is not advisable to add bicarbonate of soda or any other foreign salt to the nickel bath. Bronze powder may be used instead of blacklead in preparing the glass for a copper deposit. Other metal powders have also been used for the same purpose with some success.

Polishing Pebbles.—Pebbles may be cut and polished by an amateur with the requisite patience, an old sewing machine serving as the basis of a cutting machine; but in place of the ordinary wheel it would be necessary to put a heavy fly-wheel, say of about 20lb. weight and about 10in. in diameter, with a pulley about 6in. in diameter attached. On the table should be screwed two wooden blocks with bearings for a 1-in. iron pipe, to which should be attached a pulley about 4in. in diameter, and two nuts for bolting on the cutting and polishing discs. The cutting discs should be of thick copper about 4in. in diameter, bevelled at the edges, and fed with emery and water. The polishing discs will be one of copper (about 6in. in diameter) covered with fine sand and water, one of wood covered with crocus and water, one of wood covered with leather and whiting, and one of wood covered with felt and dry putty powder.

Softening Bearskin Rug.—To render the bearskin supple, sponge it at the back till soft with hot water, then, before the water dries out, well rub the skin with olive oil, and continue rubbing with a little oil for two or three days; this will prevent the skin hardening again. To comb out the matted parts, sponge them with warm water to which a little carbonate of soda has been added; if this does not loosen the dirt, sponge with paraffin oil and comb with a coarse comb rubbed with oil. A little oil on the hair will give it a good gloss and finish.

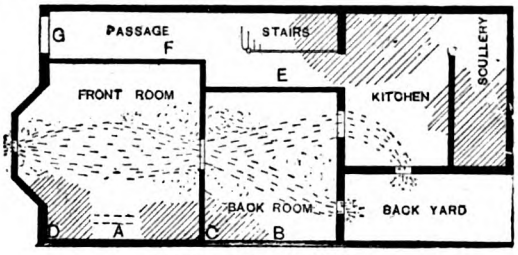
Tumbling Drum for Cleaning Rusty Metal Articles.—The accompanying illustration shows a tumbling drum suitable for cleaning rusty nails, etc. The apparatus consists of a barrel, with a door in it, which runs eccentrically on a spindle, the spindle being driven either by hand or steam. If driven by hand, a handle can



Tumbling Drum for Cleaning Rusty Metal Articles.

be substituted for the pulley. Into the drum is placed some river sand, moistened with dilute sulphuric acid, and then the articles to be cleaned. When the drum is revolved the articles are continuously being shifted, so that every part of them becomes polished.

Removal of Dry Rot.—Dry rot has appeared in a house, a sketch plan of which is shown by the accompanying illustration. About eight years after building, the boarded floor of the kitchen was very badly affected with dry rot, and it had to be raised, filled in with earth and gravel, and the floor covered with coloured tiles instead of a new boarded floor. Later, the drawing-room floor became badly affected. According to the sketch plan, the house appears to be on the whole fairly well provided with ventilation, the arrangement of ventilators being quite a usual one for houses of this kind. The plan shows a terrace house of the usual bow-window, no-basement type. The front room, back room, kitchen, and scullery stand successively to the rear of each other; and are connected under the flooring by air-way openings in the walls, in the usual manner. An external ventilator is fixed under the bow window in front, and air-ways open from the kitchen into the backyard, at the rear; and also from the back room into the backyard. There are three ways in which the inception and the spread of dry rot in wood can positively be prevented. (1) By subjecting the wood to the action of a continuous current of fresh air; (2) by coating or charging the wood with solutions of various mineral salts, etc.; (3) by keeping the wood exposed to very high (over 150° F.) or to very low (below 32° F.) temperatures. The first method is a sufficient and ample protection when effectively carried out; but that efficiency is only to be determined by the success of the particular case. The means generally adopted for putting this preventive method into effect is by various systems of ventilators; but from the differences that exist in the elevation of houses, in their immediate surroundings, and in the nature of the soil upon which the houses are built, obviously the same system of ventilators cannot be equally effective in every case. Under the lower floors of nearly every building erected dampness is constantly present in the air; if ventilation is absent in all cases, the degree of dampness will vary in different houses according to the conditions mentioned above. The dry-rot fungus thrives best in the dampest situations, and will grow fairly well in even really wet places; though the fungus cannot stand complete immersion. Now, if to a fungus growing under the floor of a damp house a little air is admitted, the fungus will not only continue to grow but will be benefited. If more ventilation still is allowed, the fungus thrives beyond all reckoning; but by admitting more and more air a stage is presently reached at which the fungus wilts away and dies. At this point effective ventilation has been secured. The explanation of this is that the fungus before it can grow well must have some air, as well as plenty of moisture. (If the place where the fungus grows is also warm, as, for example, in the vicinity of a fireplace, the life and growth conditions will clearly be equal to the best that could be obtained in a forcing house.) But when new supplies of air are admitted so rapidly that the atmosphere under the floor is no longer moist and semi-stagnant, then the conditions become unfavourable to this low form of life, and the fungus is unable to thrive. First the moisture is withdrawn from the air in which the fungus grows, then the moisture is taken from the timber to which the fungus is attached, and lastly (more important than all) the moisture in the fungus itself is absorbed by the ever-passing current of new air, and the fungus shrinks, becomes shapeless, and dies. Dry timber and the dry-rot fungus therefore cannot exist for long together in the same place. Given damp timber to which a voracious fungus is attached, fresh air plentifully admitted and directed so that it plays on the fungus must of necessity kill the fungus in the end; but the volume of air may be much or little, this factor varying according to the natural humidity and situation of the site under consideration. On the other hand, admitting air that is insufficient in quantity to kill the fungus, only increases the evil. In



Sketch Plan of House.

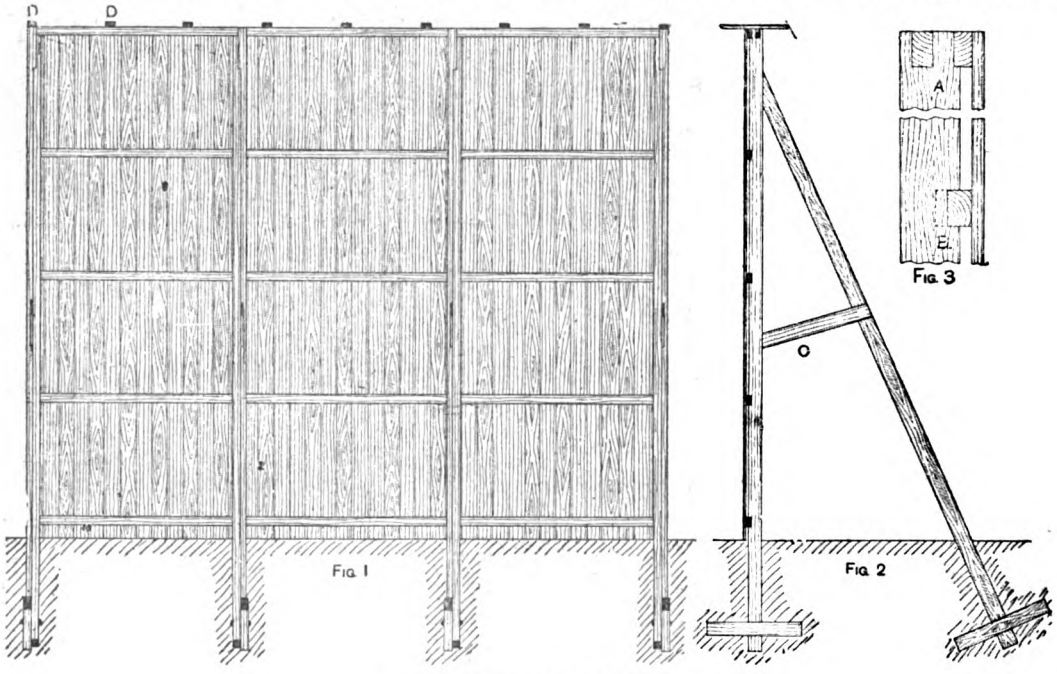
the house here illustrated, the quantity of air admitted may be sufficient, but the currents are not broken up, as they should be, in order to affect equally all parts of the floor. This breaking up of the current may be accomplished by placing obstructions in suitable positions; dwarf walls, with air-openings alternately in the middle and at opposite ends of the walls, are generally very effective. In the case of this house, which is without dwarf walls, an upright boarded screen resting on the ground 1ft. away from the opening would break up the current considerably. If fireplaces occupy positions at A and B, then (under the present conditions) the shaded portions are very liable to become affected with dry rot. A ventilator might be placed at D, in the front wall if possible, or else in the side bay of the window, and an air-hole made at C; if there is no riser at the front door that could be taken out and replaced by a ventilator, a small floor grating ventilator should be inserted just inside or outside the front door. For additional security air-ways might be made at E and F. As hard floors have now been provided to the scullery and the kitchen, these floors will not require attention. In conclusion, a house should be provided with large ventilators, capable of admitting a considerable volume of air. The current of air should on entry be dispersed and distributed over the whole of the floor area, thus ensuring under the floor a similar atmospheric condition to that which exists outside the building; in such circumstances the dry rot fungus cannot live.

Scented Jelly.—To prepare a scented jelly, soak 1 oz. of gelatine in 5 oz. of water, and keep in a warm place till dissolved. Melt by gentle heat, stir in a few drops of scent, then pour into a shallow tin mould. When cold, cut into squares. If it is desired to have the squares dry, rub them with powdered starch. If kept very long, these squares will dry; to obviate this, instead of 5oz. of water use 3oz. of water and 2oz. of glycerine.

Filing up Clock Pinions.—Filing up worn clock pinions makes a very poor job; a narrow wedge-shaped fine-cut file should be used, and the pinion rested on a wood block. When the worn pits have been filed out, the file marks must be removed and the leaves smoothed by oilstone-dust and oil on a wood polisher

Renovating Fireman's Leather Helmet.—To renovate a fireman's leather helmet which is very much scratched, well sandpaper the helmet till it is quite smooth and level, then apply a polish composed of 5 lb. of white wax, 5 lb. of brown soap, and 50 oz. of cocoanut oil. Melt the wax over the fire, then dissolve the soap therein, cut up small. When homogeneous, stir in black and blue pigments, and finally the cocoanut oil. Stir until all the ingredients are thoroughly incorporated and until the preparation is cold to prevent separation of the wax, then pour out into tins or moulds. Rub a little of the wax on the patent leather, then polish briskly with a clean rag.

Hoarding for Bill Posting.—Fig. 1 shows a back view of a bill posting hoarding 16 ft. high and 20 ft. wide, properly supported with stays at the back. Fig. 2 is a side view. The main framing is formed of four posts of 5-in. by 3-in. stuff, and the head is of 5-in. by 3-in. stuff also. The best plan will be to mortise and tenon these parts together as shown by the section at A (Fig. 3),



Hoarding for Bill Posting.

where the head overhangs 1 in. at the front; the reason for this is that the horizontal rails (which are 3 in. by 3 in.) and posts are notched together, 1 in. being taken out of each. This makes a strong job, does not materially weaken the posts or rails, and causes 1 in. of the horizontal rail to project (see B, Fig. 3). The posts are sunk 3 ft. or 4 ft. into the ground, and as an additional security crosspieces about 3 ft. long should be bolted near the bottom of the posts as shown. The whole will be kept in a vertical position by four braces or stays as shown at Fig. 2; these would be lapped on and bolted at their top ends to the posts. To give further strength and to render the braces more rigid, struts should be provided and fixed by bolts to the post and braces as shown at C (Fig. 2); both these members should be 5 in. by 3 in. Crosspieces should be bolted to the bottom of each of the braces and sunk 3 ft. or 4 ft. into the ground. The feet of both the posts and braces should be firmly secured by well ramming the earth around them. If the ground is of a soft or treacherous character, lay a bed of concrete in each hole and fill in and ram concrete well round the feet of the posts, etc.; if the ground is of a firm character, this precaution will be unnecessary. The best material for the face of the hoarding will be ½-in. prepared floorboards, secured by 2½-in. or 3 in. floor brads; but grooved and tongued floorboards, though a little more expensive, preserve a truer surface. At the top of the hoarding are shown some projecting strips (3 in. by 1½ in.), which are nailed to the head; these strips will prevent the top end of the ladder slipping when the bill-poster is at work. For a permanent hoarding good red deal is the most economical wood, but for temporary purposes common white deal is frequently used. The best preservative for the parts of scantlings that are buried in the ground is a couple of coats of tar. Tar may also be used as a preservative for the upper portion, but if tar is considered unsightly, a couple of coats of good oil colour may be applied.

How to Use Transfers.—Transfers as used by decorators, coach painters, japanners, and wood finishers are generally printed on two kinds of paper; thus bronze names and gilt decorations as used for the name-plates and ornamentation of cycles and metallic bedsteads are generally printed on a very thin tissue-like paper, while transfers in colours are printed on a much thicker paper, and in many cases on holding them up in strong light the design and colours can be seen clearly defined. High grade goods of foreign manufacture have printed on the back of the paper an outline tracing of the design corresponding with the position of the printed design; this enables the operator to fix the transfer in position with the minimum of trouble. Where this outline is not printed the paper should be held up in a strong light to enable prominent tally marks to be pencilled on. In most cases the transfers are sold by the printers in sheets only, the number of separate designs on each varying, of course, according to their size. Some transfers do not appear transparent when held up to the light, but are coated or backed with gold or silver, which in some cases gives the impression that they are metal transfers. This metal backing forms a protective coating to the design, and prevents the colour of the ground interfering with or obscuring the colours of the transfer. As a guide, metal covering is necessary on black or dark grounds, and white covering on light coloured grounds, but no covering is needed on white or light tinted grounds. Transfers in which gold, silver, or pearl form part of the design require no covering, as metal forms a component part and comes on last in the printing. As a rule there is an extra charge for transfers that require special or metal backing. Decalcomania transfers, manufactured in Chicago, are of high grade. Their colour designs are issued with a special warning that "all transfers when just completed are fresh and delicate, and the colours at such times, not being thoroughly dry, are easily affected by the cleaning substance. The best precaution is to take as many transfers as are needed for immediate use and place them between a newspaper or catalogue in an oven where the heat is about 110° F., leaving them there from twelve to twenty-four hours, at which time the oil in

the colours will be thoroughly dry." This is of special importance where the designs have been printed in accordance with special requirements, such as name tablets or colour designs, to suit special articles. Stock goods do not require this drying process. A good foundation for a transfer is necessary. If the article is painted or japanned the transfers should be put on after the first coat of varnish is hard, and on polished wood all staining, colouring, and embodying should be done first. Marqueterie transfers, which give a perfect imitation of inlaid woods, should be applied when the pores of the wood are filled with polish, and should afterwards be polished with white or transparent polish; they may be successfully used for decorating japanned pulp ware, polished or varnished wood, oilcloth, leather, glass, wax, or stearin such as candles, indiarubber, and celluloid goods. In fact, any hard clean surface that is non-porous can be so treated. It is not absolutely necessary that all transfers should be coated with varnish or French polished, but in all cases where it can be done such treatment is advised, as it tends to keep the

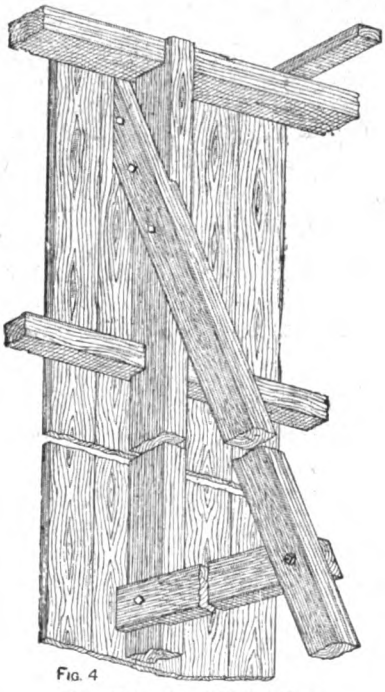


FIG. 4

Hoarding for Bill Posting.

transfers clean, prevents accidental scratching, protects gold decorations from tarnishing, and, in the case of imitation inlaid woods, tends to add depth and solidity. The transfers must be cut from the sheet with a margin of white paper around the design, and tally pencil marks should be put on the back and corresponding marks on the article to be decorated. Place the design, face upwards, on a sheet of newspaper, and with a camel-hair brush apply a thin even coat of transfer varnish. Do not cut in the design, but, first stroking out most of the surplus over the edge of the varnish pot, apply the varnish over the whole of the paper. When the varnish has become tacky, pick up the transfers carefully and place them, picture side downwards, where required. Then with a pad of soft rag, press well down, starting from the centre and working towards the edges to drive out all air bubbles. In the case of stiff papers which do not sit well, slightly damp the back with a sponge moistened in clean warm water, then press well down again to force the design against the surface. A rubber roller (squeegee) as used by photographers will be necessary in the case of large designs and if several transfers are being handled. It is essential that the transfers should be in close contact with the surface in every part. Allow them to remain at least half an hour, and if possible longer, as the picture then unites more firmly with the surface. Next with a soft sponge and warm water damp the back of the paper, and press down again, using either the pad or the roller. Then apply water more freely till the transfers are well soaked, lift a corner, and carefully peel off the paper. Wipe up the surplus wet by gently dabbing with a clean moist chamois leather, and when perfectly dry the transfer may be varnished or polished as the case may be. Surrounding some of the designs is found a film of varnish and mucilage, which, when the work has been unduly hurried, is of a whitish appearance. If the article is to be French polished this is of little consequence, since what may be left after sponging with water will usually disappear when wiped over with raw linseed oil before applying the polish. Where an oil varnish or gold size has been used as a fixative and oil varnish will be employed as a finish, the white film may be removed by another sponge saturated with kerosene, benzine, or turpentine mixed with a small amount of water, any surplus left on the face of the design being afterwards wiped off. For articles with a foundation of paint or oil varnish, a first-class quick-drying oil varnish may be used as a fixative, and should be reduced with turpentine to enable it to flow freely and acquire a sufficient "tack" in about fifteen minutes. On French-polished goods any spirit varnish will do, though for gold and pearl inlays a transparent varnish gives the best results and should acquire the proper tack in a few seconds. On wax or enamel glaze surfaces, best gelatine, dissolved in hot water, or pale gold size may be used as a fixative. For coach-builders' work, the transfers may be affixed by pressing the picture on before a coat of varnish is quite dry. Further information on fixing transfers is given in Series I., pp. 225 and 301, and in Series II., pp. 89, 137, and 202.

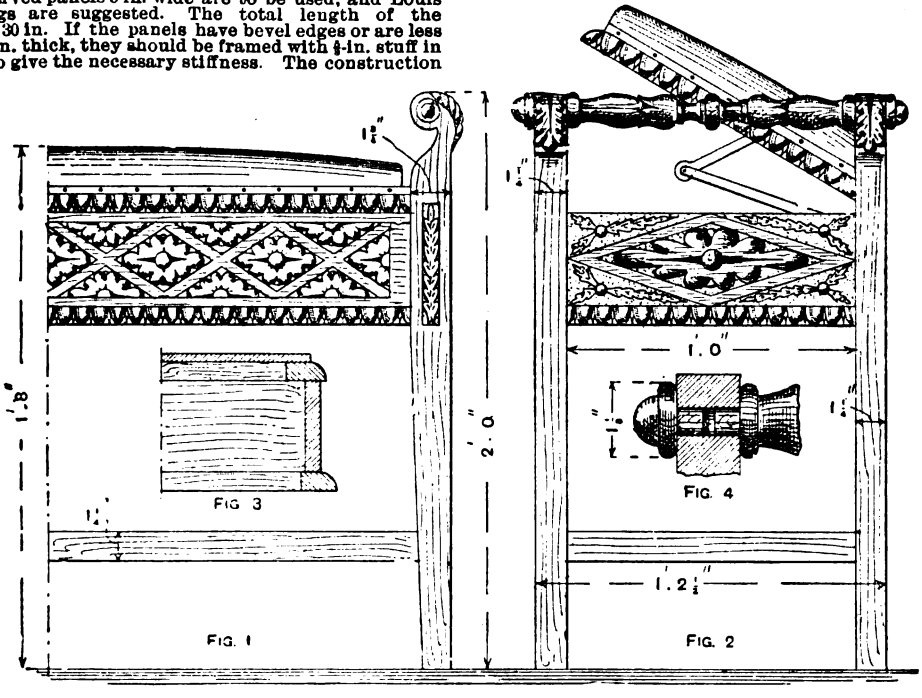
Keeping Paint and Enamel Brushes Clean.—The following is a simple method of keeping paint and enamel brushes clean. For dealing with several brushes that are being frequently used for paint and enamel in various colours, to keep them from touching one another, and yet in compact form, get a jam jar, the size, of course, depending on the number of brushes it is to contain, and procure some scraps of sheet metal, about 3½ in. by 2½ in., zinc for preference, being rust-proof. Bend these around a rod or tube, thus making them into tubes about 2½ in. by 1 in. in diameter. These dimensions, of course, may be altered according to the size of the brushes. Now if these tubes are placed upright in the jar, and as many sprung in as will hold altogether fairly tight, it will be found that they form cells into which brushes may be placed separately, and without fear of coming into contact with one another, and the jar, if kept nearly filled with water, will effectually preserve and keep clean any brushes that may be placed in it.

Systems of Hot-water Supply Compared.—The case for and against the tank and the cylinder systems respectively of hot-water apparatus may be stated as under. As the cylinder system is the more modern of the two, an idea prevails that the cylinder system was introduced as an improvement on the tank system and with the intention of entirely superseding it. This idea is a wrong one, for each system has its advantages and its faults. In the tank system the hot-water reservoir is above the taps, consequently the failure of the cold supply means that the apparatus is very likely to be emptied of water. But failure of the cold supply is very improbable, and practically impossible, in towns that are served with water from a company's mains, but would not be an infrequent occurrence in country houses in which the water is supplied by a pump. The advantage possessed by the tank system is the satisfactory flow from the taps, the water flowing full and rapidly from all taps, both high and low. In the cylinder system the hot-water reservoir is below all the tap branches and cannot be emptied (except by a special cock), and this arrangement ensures safety should the water supply fail. On this account the cylinder system is nearly always adopted in country residences. The fault of the system is the poor outflow at the taps, particularly the high ones, from which sometimes the water only dribbles, and as the bath tap is usually the highest, a poor outflow there naturally causes considerable annoyance. The best remedy is to make the cold supply pipe of full size and not choked, but even then the outflow at the high taps is seldom satisfactory. In order to meet this difficulty a combination cylinder-tank system is growing in favour for country houses, as this combination system possesses the advantages of both and the faults of neither. The heating qualities of the tank and the cylinder systems are equal, for as the boiler does the heating, each apparatus must, if other conditions are equal, contain the same amount of heated water for the fuel burned. In the tank system the tank is usually put in a cold place and the long run of pipes left exposed; both tank and pipes should be covered to prevent loss of heat. In the cylinder system the cylinder is in a warm place; and though the heat from a cylinder sometimes makes a kitchen hot, this inconvenience can be remedied by encasing the cylinder with non-conducting material.

Removing Top from Seltzogene.—Plaster-of-Paris cannot be removed by any method of solution, hence physical means will be necessary. Fit sheet-lead jaws to a small vice, grip the top of the seltzogene gently with the vice, and twist the bottle slowly. With care the top may be removed, but it must be remembered that the metal is soft.

Aluminium Bronze Paint. — Aluminium bronze paint, which is used for cycle rims and luminous work generally, is prepared by mixing celluloid varnish with aluminium bronze powder. To make a small quantity, place in an earthenware bottle 1 oz. of colourless celluloid clippings or waste, shredded fine, and ½ pt. of acetone; agitate at intervals until the celluloid softens, then add 1 pt. of amyl acetate and ½ oz. of castor oil. Mix well together and place aside to repose for several days; the preparation is then ready for mixing with aluminium bronze powder.

Duet Music Ottoman.—A design shown in part elevation in Fig. 1 is a suggestion for a duet music seat with box; carved panels 5 in. wide are to be used, and Louis XV. legs are suggested. The total length of the seat is 30 in. If the panels have bevel edges or are less than ¾ in. thick, they should be framed with ¾-in. stuff in order to give the necessary stiffness. The construction



Duet Music Ottoman.

will be understood on reference to Fig. 3, which is a section through the carcass. The underframing will add greatly to the strength of the legs. Fig. 4 shows how the handles and tips are secured to the scroll heads. The lid must be hung with not less than three brass butts and a rule joint at each end (see Fig. 2). Oak is entirely unsuitable for Louis XV. or cabricole legs. The legs as shown could be further decorated with a narrow bubble ornament from toe to scroll on two sides.

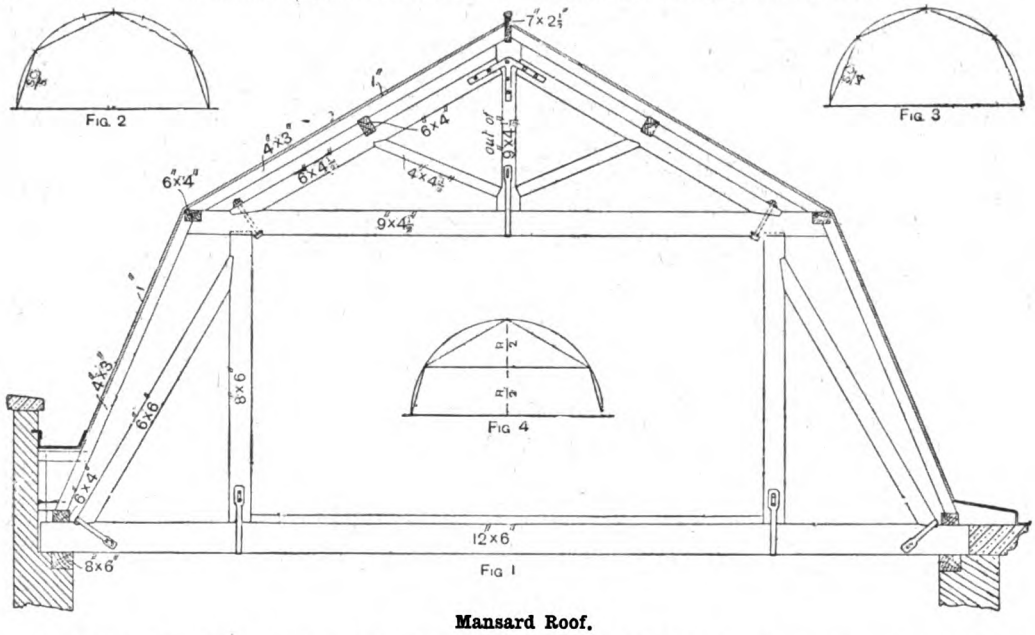
Galvanising Wire.—The plant required for galvanising small articles made of wire would be, first, a cast-iron oblong pan about 9 in. deep and of a suitable length and width, with tapering sides and flanged top; an outer shell of brickwork is built up to the height required to carry the pan, a fireplace, fitted with fire-bars, being provided underneath for melting the zinc in the pan. At the front end the fire-box is closed with an iron door, and the opposite end is bricked in, with the exception of the space left for carrying off the burnt gases into a suitably arranged chimney. The iron to be galvanised must be pickled quite clean, and be absolutely free from all scale spots; pickling is done by immersion in warm sulphuric acid, after which the metal is well rinsed in clean water. Prepare a good bath of molten zinc, the temperature being kept well above the actual melting point, and the metal protected from oxidation by a covering of breeze or of sal-ammoniac. The cleansed articles are then dipped in hydrochloric acid, and the surface is also sprinkled with powdered sal-ammoniac; then immerse in the molten metal for a short time, and if upon withdrawal the article is not properly coated, sprinkle some more sal-ammoniac upon the uncoated part; immerse again in the molten metal, repeating this operation until the desired coating is obtained.

Use of Drainage Level.—To use a drainage level, set up the tripod and open the legs to a convenient distance apart for stability, screw the level on to the top, and point in the direction required, say to read the height on a staff held at a bench mark; then tilt the level until the bubble is in the centre, and take the reading. Then shift the staff to the point where a comparative height is required, turn the level in that direction, and again adjust the bubble and take the reading. The difference between the two readings will be the difference in level between the two points. The ball and socket joint should be provided with a clamping screw in order to hold the spirit-level when adjusted, as otherwise, after frequent use, the joint becomes slack and will not stay in position.

French-polishing Inlaid Table Top.—Below is described a method of polishing an inlaid table top so that the inlaid woods may retain their natural colours. White polish made of bleached shellac (this is obtainable at druggists' stores) should be used. The shellac should be broken up small and spread out on paper in a warm room (say for twenty-four hours), turning the shellac occasionally until it feels quite dry; great heat is not required, as heat causes the gum to mass together again. Dissolve 6 oz. of the lac in 1 pt. of methylated spirit; place the bottle (with a loosely fitting cork) where it can be gradually warmed to blood heat, and the lac will readily dissolve. The table top should be wiped over with raw linseed oil and the polish laid on with a rubber; a suitable rubber is made with wadding enclosed in a rag covering. Many applications of the polish will be required to produce a level lustrous surface, as no grain filler will be used, and the woods employed for the inlaying vary in the texture or openness of their grain. A little pumice powder sprinkled on the work as the polishing proceeds will greatly assist in driving the polish into the grain, and will also help in grinding the polish level. A transparent polish that may be used instead of the above recipe is sold at some stores.

Turning Watch Fusee Ratchet.—Pick out a fusee ratchet of the right size, and to ascertain this place it on the maintaining ratchet and see that its teeth will engage properly with the clicks. Take the fusee and cut off the old pins that fastened the ratchet. Open out the centre hole of the new ratchet to push tightly on the fusee arbor down to its place. In this position drill the two pinholes well into the fusee brass, and fit and drive in two pins. File them off flush. If a lathe is available, fix the fusee in a split chuck and turn it down to correct thickness, and turn out the centre to free the pipe of the maintaining ratchet. If the job has to be done in the turns, a special fusee arbor in which to hold the fusee will be required, and can be obtained at watch-tool shops.

Mansard Roof.—The usual method of constructing a mansard or curb roof is to make it in the form of a king-post truss resting on a queen-post truss (see Fig. 1). The angles to which the sides of the trusses are made are obtained by different methods, as indicated in the



Mansard Roof.

smaller diagrams; in Fig. 2 the semi-circumference is divided into five equal parts; in Fig. 3 the semi-circumference is divided into four equal parts; and in Fig. 4 the height is divided into two equal parts. In Fig. 1, in order to give clearness to the drawing, the slates are not shown, but the roof boarding is indicated. The eaves may be arranged either with a parapet wall and gutter behind, or with a cornice and gutter. The main object of using a mansard roof is to effect economy of space, or to keep the main walls low whilst forming an additional room in the roof, a chamber being constructed within the truss of the queen-post.

Small Silver Castings.—For casting some candlesticks in silver, the following procedure is suggested. Well vaseline the candlestick to prevent it sticking, then take a slab of metal or slate to form the mould on, or if wood is used fix it on a frame, allowing about 1½-in. margin all round the candlestick. Make a thick cream of Parian cement, beating it up till no air bubbles exist, and run in the mould to a depth of ¾ in. to 1 in. Allow it to set, and, when it is sufficiently dry, place the candlestick on it and run on a further quantity of the cement till the pattern is half covered. Of course, the end containing the candle must be plugged with a piece of cork, also the bottom, unless this is desired solid. Let the mould dry for about eight hours, and then well vaseline its top to prevent the second half sticking. Cut in several small dome hollows to act as checks, and vaseline these. Run in more cement till the stick is covered to a depth of 1 in. or more, and allow this to set, when the two halves will come apart and the stick may be removed. Holes and channels for the pouring must be cut, and pattern cores must be inserted for the hollow of the stick and base, when the mould will be ready for cramping up. The silver should be heated in a small plumbago crucible, the metal being only just melted under a layer of charcoal to prevent admission of air. The mould must be warmed before use, and the metal must be carefully poured into the mould. The casting will be very smooth, and if care is exercised no blowholes or air holes will be found.

Lead Pencil Making.—Originally, graphite for lead pencils was cut from blocks with great labour and much loss. The graphite is now finely ground between stones, made into a paste with water, and dried. It is then broken up, passed between rollers, and mixed with the finest clay previously tempered with water. The amount of clay added varies with the hardness required in the pencil. The mixture is placed in a cylinder provided with a piston, by means of which it is forced through holes of the desired dimensions. The sticks are cut into lengths and laid in grooves in a board till dry. They are next roasted in an oven and, when cold, glued into the woods. The pencils are rounded by revolving cutters then glasspapered and varnished.

Dyeing Bone.—Here is a recipe for a good and cheap black for dyeing bone to a depth of $\frac{1}{16}$ in. or $\frac{1}{8}$ in. First boil the bone in a solution of washing soda to remove grease, then wash in clean water. Prepare two separate baths, one consisting of 2 oz. of logwood chips boiled with 1 qt. of water and strained, the other made up of 1 oz. of sulphate of iron (copperas) in 1 qt. of water. Boil the bones first in the logwood liquor for fifteen minutes, then remove and boil in the sulphate of iron bath for an equal time; remove, dip in warm water, and dry slowly.

Transparent Soap.—A good soap is first made preferably from oils, and is dissolved in hot spirit of wine; the impurities are allowed to settle out, or are filtered off, and the pure transparent soap solution is evaporated to dryness in a closed pan, the spirit being recovered by using a still-head and condenser. The soap is then moulded. The alcohol or spirit of wine is used over and over again, but there is always some lost each time it is evaporated, and this has to be replaced from time to time.

Removing Earthy Smell from Wine Cask.—In the case of an oak wine cask that has contained garden soil for about twelve months, take out the head of the cask, first marking it and the staff opposite so that it may be returned to the cask exactly as it was before. Scrub the cask with hot water and soda, and if any smell remains after this, take off all the hoops except the end one on that end that has the head in, knock off each staff separately, shave the inside, and return the staves to their places again; also shave the heads and replace in the cask. If the cask is sound, the above method should prove a remedy.

Incubator Regulator.—Metal regulators for use in incubators are not found satisfactory, as the expansion and contraction of metal which is only subjected to 104 F. does not affect them sufficiently to be practicable. The writer recommends spirits of ether and pure alcohol, which boils at 104° F. It is placed between two thin discs of hard brass about 3 in. across, hermetically sealed with a soldering iron, and then placed on the stand in the middle of the machine, a ¼-in. wire being passed through the centre of the tank and rested on the centre of the capsule. The upper end of the wire comes under the regulating screw in the damper rod, so that directly the thermometer registers 104° F. the capsule suddenly expands. A metal regulator will not do this, as it expands gradually as the heat increases; consequently heat is lost before the necessary registration is obtained.

Grooving Sides of Step Ladders.—For grooving the sides of step ladders, adopt the following method. After setting out the grooves, the sides should be secured to the bench by two hand screws, or similar means, and the sides of the grooves should be formed by sawing. To facilitate sawing to the right depth, on a saw fix two strips B of wood by two screws, or better still small bolts or nuts, using one strip on each side of the saw as shown at Fig. 1. so that the bottom edges are distant from the teeth the depth of the groove. Where sides are constantly being made it is a good plan to file at each end of the saw a small hollow A in which will rest the bolts holding the strips: this prevents the strips being displaced. Part of the waste in the grooves can next be taken out with a chisel, and, except where knots are present, this can be done at one stroke. Next, the remaining waste may be removed by means of an old woman's tooth or router (Fig. 2). This and the form shown at Fig. 3 can easily be made of any hard wood, and will be found of a very useful kind, as the piece which is screwed on the bottom will make the tool work smoothly.

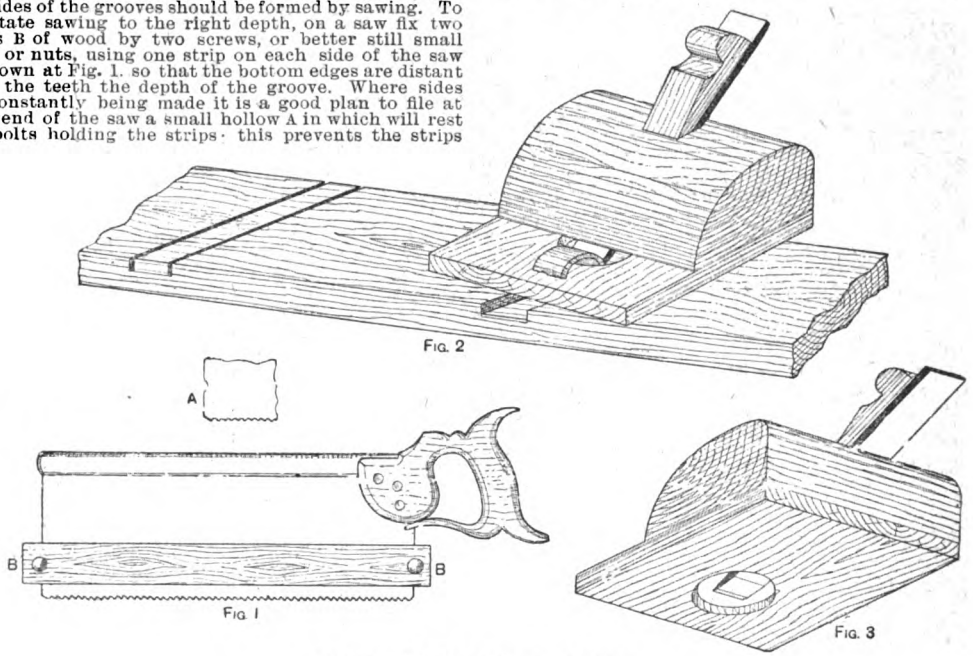


Fig. 2

Fig. 1

Fig. 3

Grooving Sides of Step Ladders.

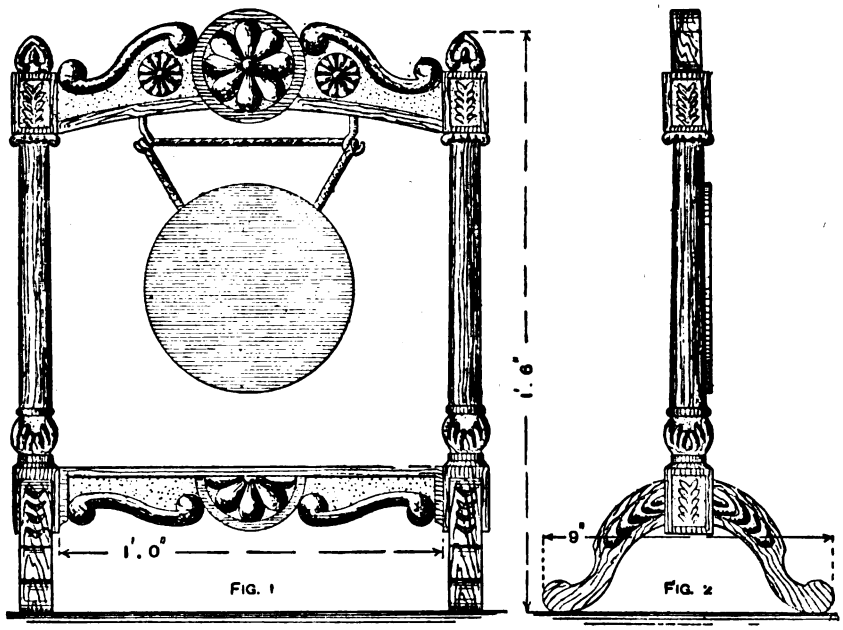
White Pigments.—Permanent white is a pigment which is more commonly known as barytes; it is a sulphate of barium, and is obtained both from artificial and natural sources. However, the natural barytes is generally used, being widely distributed in various parts of this and other countries, and it is known to the lead miners as baryta, spar, or "cawk." To prepare it for use it is subjected to levigation in water, and then bleached, to remove any trace of iron which it usually contains; it is then dried and ground to a paste in oil. Barytes is unaffected by acids, alkalies, or atmospheric influences, by reason of which it derives its name, permanent white. It possesses very little colour or covering power, and is seldom used alone, but is largely used as an adulterant for other pigments. The artificial variety is prepared by precipitation, and is a much finer white than the natural variety, but is rarely used on account of its high price. Flake white or white-lead is made by a variety of processes, such as the Dutch or stack process, the chamber, electric, dry and wet precipitating processes. By the stack process, which is principally used, a layer of spent tan is placed on the floor of a suitable building. A number of earthenware pots are then placed on the tan, in the bottoms of which is placed a small quantity of dilute acetic acid. On a shelf inside the pot and above the acid a thin coil of lead is placed, boards on the pots forming shelves for another layer of pots. Thus a stack, containing many tons, may be built up. The stack, when completed, is closed, and the tan ferments, giving off carbonic acid gas, which converts the acetic acid in the pots into vapour. This attacks the blue lead, and converts it into normal lead acetate, finally forming white-lead. This is then crushed, and all blue-lead and other chemical impurities are removed by careful washing and levigating, and the material is dried and finally ground in oil for use as paint. White-lead has excellent covering properties and permanency. It can be mixed with all pigments except those containing sulphur, as ultramarine and cadmium yellow. White-lead or flake white is largely adulterated with barytes, but it may be tested by heating with dilute nitric acid, in which it is completely soluble. Zinc or Chinese white is prepared from the metal zinc by combustion. The method usually adopted is to throw ingots of zinc into suitable retorts at a white heat. The zinc volatilises, and is collected in large chambers connected with the retorts. Zinc white is a permanent pigment, and mixes well in both oil and water, and can be mixed with all other pigments without being affected. Its only fault is its bad covering power. For many purposes it is used as a substitute for white-lead on account of its non-poisonous properties. Zinc white is often adulterated with china clay and barytes, but its purity may easily be determined, as it entirely dissolves in dilute acetic, sulphuric, and hydrochloric acids, with which it gives colourless solutions.

Methylated Spirit Soldering Lamp.—A spirit lamp for soldering is best made from a brass tube 8 in. long by 1 in. in diameter, closed at the bottom. The tube is loosely filled with cotton wick, and spirit is poured on this and finds its way through the wick, which should be pushed down so that it is flush with the open end of the tube. A soldering lamp ought not to be near a reservoir of spirit or it would easily take fire, and the suggestion that a teapot be used as a lamp is out of the question. If a reservoir is desired, it should be of tinplate, closed, and with a tube 2 ft. or 3 ft. long to connect it to the lamp; it should also be supplied with a tap, and fixed at the proper height to give the required flow of spirit.

Terebine.—Terebine, a powerful liquid drier, may be made by mixing together 1 part of best boiled linseed oil and 3 parts of turpentine, or for very rapid drying, 1 part of japan gold-size instead of the boiled oil. In reply to a further question, water cannot be mixed properly with petroleum; an emulsion may be made of the two by using a small quantity of yolk of egg.

Painting Ironwork of Mangle.—Here are instructions on painting the ironwork of a large mangle a red colour that will dry hard and glossy. First remove all the old paint by means of a blowlamp, or by a pickling solution made by dissolving ½lb. of caustic soda in ½gal. of warm water. Rub this over the work repeatedly until the paint softens, when it may easily be removed by means of a scraper or knife. One or two coats of orange-lead mixed in boiled oil should then be given: this adheres firmly to the ironwork, and prevents the formation of rust. After the lead is thoroughly dry, apply a coat of vermilion, vermilionette, madder red, or fast red, obtained dry and mixed into a paint with copal varnish 16 parts and terebine 1 part; this will dry hard in about eight hours with a good gloss. Vermilion, madder, and fast red are expensive, but are permanent. Vermilionettes may be purchased at about one-third of the cost of the other colours, but fade after a few months' exposure.

Carved Oak Gong Stand.—Figs. 1 and 2 show a suitable design for a carved oak gong stand. The dimensions are thickness of columns 1⅝ in. square, pediment 1 in. thick by 1 ft. long, claws 1¼ in. thick.



Carved Oak Gong Stand.

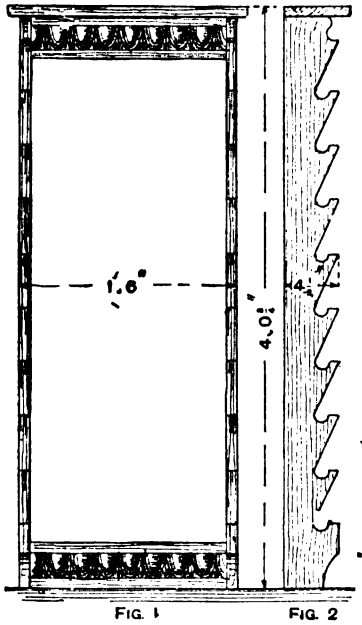
Zincography.—A convenient method of reproducing a line drawing is to make a zinc block. One of the advantages of using zinc is portability, as the plates are only about ⅛in. thick and the blocks can be used in an ordinary letterpress machine along with type; or if several copies are required an electrotype can be taken of the block and type together. Plates of Vicelli Montague zinc are used, and the surface as they come from the rolling mill is contaminated with scale and oxide. First is taken a photographic negative, which is afterwards put into a printing frame, and a piece of chemically prepared transfer paper is placed face downwards on it in contact with the film. This transfer paper is exposed to light behind the negative for a time. The paper is then soaked in water to remove the unaltered bichromate in the composition and afterwards stretched over a sheet of glass and very carefully inked over with a velvet roller. The ink adheres to the insoluble parts of the composition, but leaves the soluble parts untouched and clean. The zinc plate is then prepared for use by scraping off the scale and oxide with a cabinet-maker's scraper, and is subsequently chemically cleaned by smearing a thin layer of whiting over the polished surface and afterwards rubbing it off with a rag. This frees the plate from grease. The surface is then slightly roughened with pumice- or snake-stone, or by immersing it in a 2-per-cent. acid bath and rapidly withdrawing to wash it with pure spring water to prevent oxidisation. The plate is then warmed to remove all moisture. The photo-transfer as obtained above is then laid on the zinc, and transferred by means of a press similar to a litho press. The composition, which now includes the drawing, is sponged off and the plate gummed with a broad brush. It is then inked, and of course only the greasy lines of the drawing take the greasy ink. The plate is then thoroughly dried and carefully dusted over by means of a brush with powdered resin, which becomes incorporated with the ink. Any particles of powder adhering to the bright part of the plate are rinsed off with water and the plate is then dipped in a 3-per-cent. acid bath. It is then taken out, rinsed with clean water, dried and laid on the hearth till the drawing obtains a gloss, and when cool, the back and also the large blank portions in the front are covered with shellac varnish; this protects the parts covered from the acid. The varnish having dried, the drawing on the zinc is touched up by means of a fine brush or pen and ink. After retouching, the plate is warmed up so that the corrections may unite with the metal. The plate is then sharp etched. This is done by inserting the plate in the acid bath, and the blank metal not covered by shellac is eaten away to the thickness of plate paper. If the lines of the drawing are fine, the part eaten away must be less. The plate is then well rinsed with water and allowed to dry on a warm hearth and heated to such a degree as to make the ink run off from the sides of the several lines and points in order to resist the acid. This process is repeated according to circumstances. After the etching, the plate is cooled in a water trough, and oil of turpentine is poured over it and rubbed off again with a soft brush. With a second brush, which has been dipped in a potash solution, all traces of ink and turps are washed away and the plate is rinsed in spring water. After-etchings are done with a 5-per-cent. solution of acid similar to the above. The plates are afterwards mounted on maple-tree wood by means of pins about ⅛in. long.

Milk Cans and Churns.—Milk churns are made of strong tinned iron, and milk cans of ordinary tinned plate, whose strength varies with the size of the can. In making by hand stamped lids for small cans, a narrow strip of metal is bent round and fitted loosely to the inside of the top of the can, the ends being joined by a soldered lap seam. An edge just large enough to cover the wired top of the body is then thrown off in the jenny round the top of the rim. An oval of the same shape as the rim is then cut, an allowance for an edge being made so that the top can be edged up and paned down upon the rim. This oval is slightly hollowed before edging up, and after being paned down smoothly on the rim is soldered strongly to it.

Camphorated Oil.—To prepare camphorated oil, warm olive oil, and stir camphor with it till it dissolves. About 1 oz. of camphor to 1 pt. of oil may be used, but if it is wished to sell the article it will be necessary to make it according to the details laid down in the British Pharmacopœia.

Painting Stonework.—For painting stonework stone-colour, first fill up all holes with oil mastic or Roman cement. Then rub or flat down any inequalities with a piece of hard stone. When the stonework is perfectly dry, give it a coat of priming composed of 14 lb. of genuine white-lead, 1 lb. of patent driers, and 1½ pt. of boiled linseed oil, tinted to the required depth of colour with yellow ochre paste paint. The next coat should be made from similar material to the priming, but should be thinned down with equal parts of oil and turps. The finishing coat is mixed in 3 parts of boiled oil and 1 part of turpentine. Each coat should be allowed to dry thoroughly before applying the next.

Walking-stick Rack.—Figs. 1 and 2 show front and end elevations respectively of a walking-stick rack that is extremely simple in construction. The illustrations are dimensioned, and the sides are housed ¾ in. deep into the top, and screwed from the outside of it. Two lengths of egg and dart moulding are cut and screwed between the sides, one at the top and the other at the bottom, to relieve the appearance.

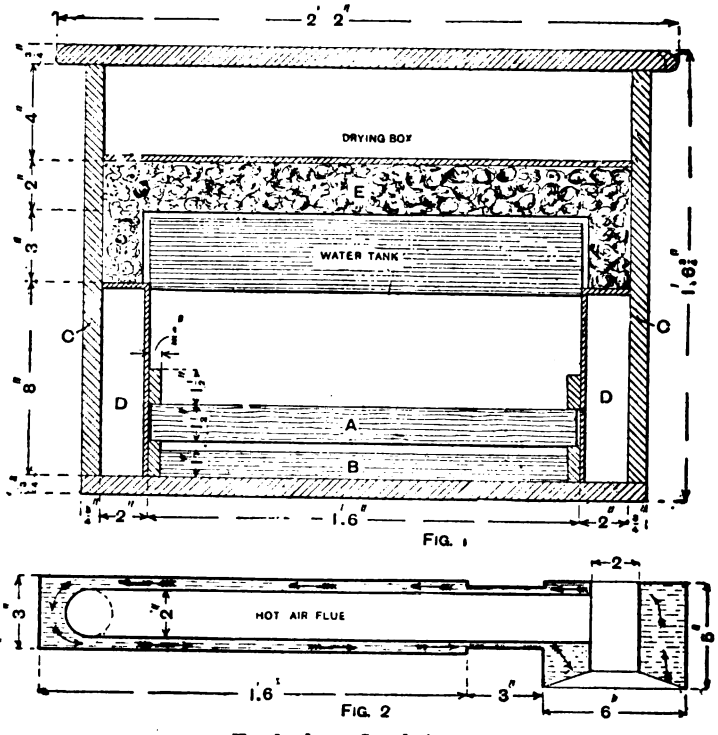


Walking-stick Rack.

Fusee Matches.—Fusee matches are made from a composition consisting of 9½ parts of charcoal, 9 parts of saltpetre, 3½ parts of powdered glass, and 3 parts of gum. The gum is dissolved in water and the other materials are stirred in to form a stiff paste; the heads are made by compressing the material in moulds in which the stems have previously been placed. After drying, the matches are tipped with a composition consisting of 1 part of red phosphorus, 8 parts of chlorate of potash, 4 parts of glue, 1 part of whiting, 4 parts of powdered glass, and 11 parts of water made into a thin cream.

Painting Galvanised Iron Buildings.—Buildings constructed of galvanised iron and situated in country districts, after being painted, should remain in a good state of preservation for at least three years. But structures of this description in any large manufacturing town should be repainted every two years, as the acid emanations from factories and chemical works interfere with the durability of the galvanised zinc coating. Such structures, if painted, will endure much longer than those unpainted, as the protective coat of zinc is also apt to shell off, especially adjoining the parts which have been riveted. These parts, however minute, once they become exposed to the action of the atmosphere, rapidly rust. When painting galvanised iron structures it is customary to give first two coats of red-lead mixed in boiled oil. This forms a hard tenacious coating, on which two coats of a less conspicuous coloured paint may be applied. Care should be taken to apply the paint freely over the joints and rivets so as to prevent the rust forming.

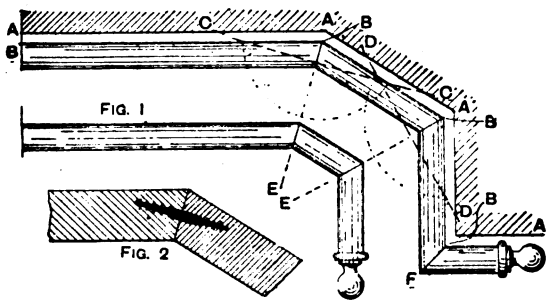
Hundred-egg Incubator.—The following particulars refer to the hundred-egg hot-air incubator which is here illustrated. The drawer A (Fig. 1) should be 18 in. square and 1½ in. deep. The runners for the drawer should be 1½ in. by 18 in. by ½ in., nailed on the bottom of the side of the inner case. The water tray B is 17 in. square and 1 in. deep, thus leaving ½ in. space between the top of the moisture tray and the bottom of the egg drawer. The distance of the bottom of the tank from the eggs is 5 in. The size of the tank is 18 in. square and 3 in. deep. The outer case C is 23½ in. square, outside measurement, and 18½ in. high, thus leaving a 2-in. (barely) air-chamber D all round the inner case, so that the air gets warmed before reaching the eggs. In both inner and outer cases ½-in. holes should be bored, 4 in. apart and 2½ in. below the bottom of the tank. These holes must not be drilled opposite each other; the holes in the inner case must come between the holes in the outer case. For making the framework use ¾-in. pine, as it stands the moist atmosphere well. Packing of silicate of cotton should be put in as shown at E. The lamp should be 20 in. long, 4 in. wide, and 1½ in. deep, with a ¾-in. "Queen Anne" burner and a chimney made of pieces of talc, put together with paper fasteners, the joints being made airtight with putty. The water circulator (Fig. 2), tank, and flue pipes are made of copper. Thus water is constantly moving, and no cold places are to be found in the tank, and the heat is uniform. The dimensions of a twenty-egg incubator are exactly the same as those of a hundred-egg machine, excepting that the tank should be 10 in. square, the drawer 10 in. square, the inner case 11 in. square, and the outer case 16 in. square; these latter measurements are taken on the inside.



Hundred-egg Incubator.

Extracting Tin from Tin-plate.—Tin is dissolved from tin-plate in a boiling solution of caustic soda, and then electrolysing this by a low-voltage electric current; but there are difficulties if a sheet or plate of pure tin is expected as the result of this process, for the dissolved tin would probably oxidise whilst dissolving, and fall to the bottom of the vat in the form of brown mud. This, when washed and dried, might be sold as putty powder or as an oxide of tin. By another process, both tin and iron may be dissolved in sulphuric acid diluted with water, and electrolysed by current from a plating dynamo, using large copper plates as cathodes. The tin scrap may be suspended in wicker baskets, with carbon plates as anodes. The tin will fall in the form of mud, and the iron solution may be evaporated to obtain the iron as green vitriol.

Bay-window Cornice Pole.—The following are instructions on making and measuring cornice poles for bay windows. Fig. 1 shows two patterns of poles; the top pole has six bends with return ends, and the bottom pole four bends only. Carefully measure the architrave of the window, and set it out full size on a floor, table top, or on the back of a length of wall-paper; this line will be A A (Fig. 1). Next get out the working line B B, which will be equidistant all round about 1 in. from A. Now set out the thickness of the pole, which is usually 2¼ in., and strike off the lines C C and D D, whose points are at equal distances from the point of the angle; bisect the lines C C and D D to get the lines E, which are the cutting lines for the joints. The lines B B will give the lengths required. Joint F will be a true mitre, and the return end can be any length required. The rings slide in the space between the architrave and the working line,



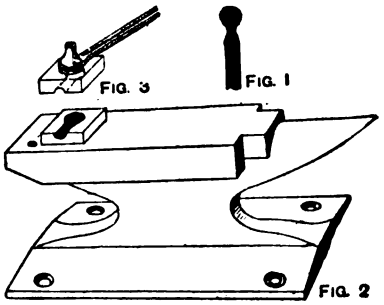
Bay-window Cornice Pole.

the hollows in the brackets corresponding. For cutting the joints use a swivel mitre box; failing this, the trough form of mitre box, which must be set out to cut the same angle as D D, can be used. After the joints are cut, on a piece of cardboard strike a circle of the same diameter as the pole, and cut out to the line; place this on the end of the pole, and pass a bradawl through the centre into the wood; do the same on the opposite face. Now screw in a stout dowel screw for half its length, then screw the opposite joint face up to contact; if not a good fit, chalk the faces, and rasp or file off until the chalk marks all over, then rub the faces with glue and screw up tight. Fig. 2 shows the method of jointing. To allow the rings to slide over the joints, these will require rounding off. The tips are fastened with dowel screws, and can thus be removed when the rings are to be slid on. Special care should be taken to work from the line B, otherwise the pole will not fit. Three brackets will be required, one in the centre of the bay and one at each end.

Putting Waltham Watch in Beat.—When the balance is at rest, the ruby pin should be in the lever notch, and the lever should be midway between the banking pins. To ascertain this, wedge the fourth wheel with a broach and let the balance come to rest. If not correct, detach the balance and spring from the balance cock, and turn the collet of the Brequet hairspring round upon the balance staff in the required direction. The collet can be turned safely by inserting into the slit the thin blade of an oiler and using it as a lever.

Setting Wheel Axles.—In setting an axle, the face spokes of the wheel at the bottom are square with the ground line, so as to set the wheel out at the top the double width of the tyre. When measuring the wheels in order to ascertain whether the axle is true, put the wheels on the axle on a level place, with the flap parallel to the ground line, and set the wheels in such a manner that the two face spokes in each wheel line with one another. Then take a ½-in. iron rod, one end of which has been turned down 1 in. so as to hook round the spokes and tyres, mark the centre of the wheel in height with a piece of chalk, put marks from the wheel on the tyres front and back, keep the wheels close to the collar, and measure the wheels outside front and back; the front part of the tyres should be ⅛ in. shorter than the hind part in order to counteract the strain of a heavy load. Then hold the iron close to the centre of the collar of the axle, and across to the edge of the opposite tyre, make a chalk mark on the iron rod, and do the same from the other side; if both tyres come true to the mark, they will be true sideways. Repeat this proceeding from the top of the axle in order to see whether both wheels are alike. No fixed rule can be given as to the allowance that should be made for contraction of tyres, because everything depends on the character and construction of the wheel: ⅛ in. is sufficient for a Warner wheel, but in the case of hand-made wheels the allowance will depend on the joint that is left in the wheel all around, or the closeness of the felloes on the shoulders of the spokes. No two cases will be exactly alike; the appearance of the wheel is the only guide.

Forging Masons' Tools. — In forging a mason's chisel first the mallet head is roughly forged to shape as shown in Fig. 1, and is, when heated, placed in a steel swage on the anvil, which has a matrix of half the head formed in it (see Fig. 2). A corresponding swage containing the other half (Fig. 3) is now used, and struck by the hammerman with the hammer, while the tool is turned round by the smith; about half a dozen blows complete the head, and the body of the tool is afterwards formed to the requisite shape. The swages are of steel and can be home made; the matrix is formed



Forging Masons' Tools.

when heated by driving into it half way the mallet head of an old tool; the swage for the other half is made similarly. In working steel for tools great care should be taken that the steel is not made too hot, or it will be burnt, although in sharpening it should be made as hot as it will stand until finishing, and should then be hammered until almost black hot, for the reason that it sets the grain finer and gives the tool a better edge; it also makes the steel tougher when hardened and softer when annealed.

Staining Vellum Green.—For colouring white vellum green the following is excellent. Place 1 oz. of verdigris (acetate of copper) and 1oz. of white wine vinegar in a bottle near the fire for five days, shaking the bottle three or four times each day. Wash the vellum over with pearlash, then colour to the shade required. The skin of vellum is very hard and greasy, and liquids do not readily "take" on the surface, so that in colouring the worker is apt to get a streaky or patchy effect. It is best, therefore, to roughen the surface by sprinkling on it pumice-or cuttlefish-powder, and rubbing over lightly with the hand. This must be very carefully done, as there must be no deep scratches. Wash the powder off carefully and proceed with the colouring. The surface is afterwards restored by rubbing paste into it with a bone folder, and when dry coating it with glair. Or the following recipe may be tried. Boil 8 parts of cream of tartar and 30 parts of crystallised verdigris in 500 parts of water; when cold pour in 4 parts of nitric acid. Moisten the vellum with a brush or sponge, rubbing firmly so as to roughen the surface, then apply the above liquid. Finish the surface with paste and glair as described above.

Nails for Securing Roof Slating.—Wire nails when used for slating are very subject to rust. The nails might be galvanised, if the cost is not deterrent; but at least, as a slight protection, the nails might be dipped in boiled oil and dried before use. Composition nails, however, are generally considered to combine the happy medium of cheapness with efficiency

Edging or Grinding Watch Glass in the Turns.—A special arbor, made in two halves, is used to hold watch glasses; the glass is placed between two circular pieces of cork, each of which is provided with a steel centre. The pressure on these keeps all together. An emery buff is applied to the edge of the glass. The arbors can be obtained at watch tool shops.

Easily Made Jewel Box.—The jewel box here described could also be used for nicknacks (see Figs. 1 and 2). It is made from ⅜-in. stuff, two sides being 8½ in. long by 4 in. wide (one of which is cut through to give a piece 1½ in. wide, making the front for a small drawer A), ends B 5½ in. by 4 in., a piece C 7¾ in. by 5½ in. for a partition to come flush with a piece 2½ in. wide, and two pieces 9 in. by 6½ in. for the bottom D and lid E. The sides and ends are butt-jointed, and the false bottom C is put in; also fix the bottom of the box, which will leave ¼ in. all round and which might be moulded. The top is fitted with two partitions F and G, making three compartments. A drawer H is now fitted with the 1½-in. piece cut from the side for the front as aforesaid, and the back is ⅜ in. thick. When the drawer is home, a bradawl is driven through one compartment in the top down into the ⅜-in.

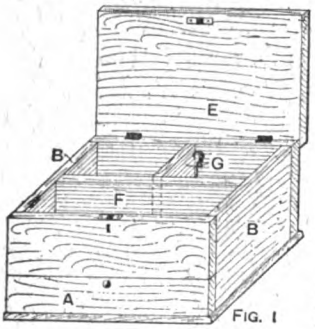


FIG. 1

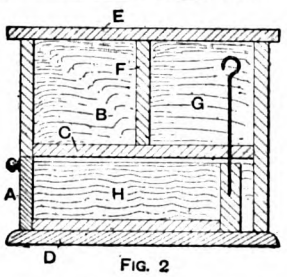


FIG. 2

An Easily Made Jewel Box.

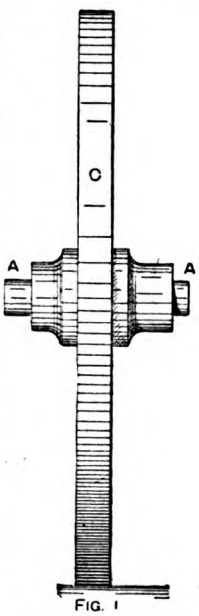


FIG. 1

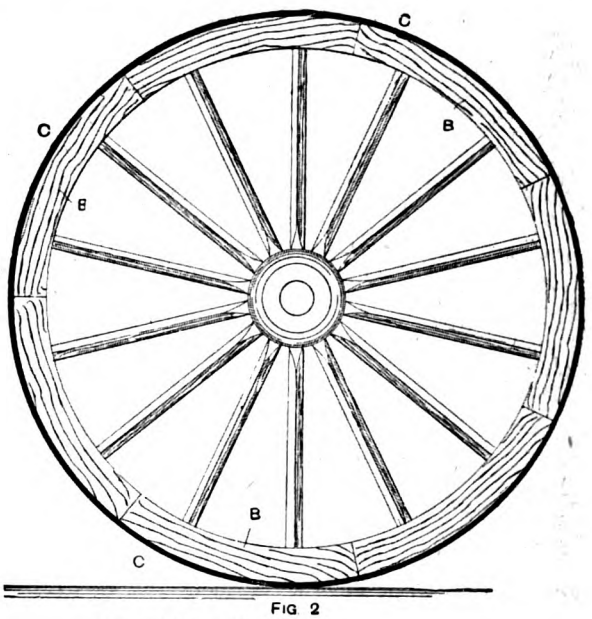


FIG. 2

Motor Wagon Wheel.

piece, and a pin made from a piece of iron wire 3 in. long is put into it, thus preventing the drawer being pulled out. When the lid is hinged and a small lock put on, the box and drawer cannot be opened unless broken.

Casting Steel.—As a rule, small steel goods are cast in iron moulds usually about 3 in. thick; dry sand moulds as used for iron may also be employed. The great difficulties experienced with steel casting are shrinking and blowholes. The shrinkage problem has not been fully solved yet, as it is almost impossible to make large, thin, complicated castings of steel. Steel castings frequently shrink upwards of $\frac{1}{16}$ in. to the foot, and the trouble will frequently arise from the hard dry sand mould which it is necessary to use in order to prevent the white-hot metal destroying the mould. The other difficulty, namely blowholes, although resulting sometimes from the gases disengaged from the metal during the operation of casting, are not always due to that cause, but may be looked for in the high melting point of low carbon steel, or in the rapidity with which the metal chills. The blowhole difficulty has been almost entirely overcome by putting a very large rising head on the casting. This is effective in two ways: it carries the sluggish metal from the casting proper, leaving the hot fluid metal to fill the mould, and the pressure also tends to force the molten steel into all corners of the mould and thus make it solid. Steel castings should be stripped as soon as poured, and with great care in moulding and high and large risers, good results may be anticipated. A good crucible cast steel consists of ordinary blister steel melted and cast into ingots. A very good alloy consists of pig-iron containing 6 to 9 per cent. of manganese, generally known as spiegeleisen. About 11 per cent. of the total quantity is first taken and melted. Scrap steel or Bessemer scrap is added till the whole quantity equals three-quarters of a crucible full. The second item is warmed first before placing in the crucible. A special pig-iron is used containing about 3½ per cent. manganese, 3 per cent. carbon, 4½ per cent. silicon, and $\frac{1}{10}$ per cent. phosphorus. A small additional lot of ferro-manganese alloy (say about 1 per cent. of the total weight) is added, the alloy containing from 50 to 60 per cent. of manganese. The mixture is well rabbled, and as soon as it is melted casting takes place. It would be quite impossible to melt steel in an ordinary furnace unless there were an exceptional draught with the heat well maintained.

Motor Wagon Wheel.—The box of the wheel of a motor wagon is of gunmetal, and the flanges are shrunk on the boxes, as shown at A (Fig. 1), made in two parts, so that they can take any size of spoke; 2½-in. spokes are generally used. The plates are bolted, as shown in Fig. 2, to the size of the spoke to be used, a small block of wood being put at top and bottom to keep the plates parallel. The spokes are then put in, a gauge being used to get them all alike. When all the spokes are driven in at equal distances apart at top and bottom, oak wedges are driven in to fill up the spaces between the spokes, and nailed. The flanges are 8 in. in diameter and 1 ft. 4 in. long; the felloes B (Fig. 2) are 2½ in. deep by 2¾ in. wide; the tyres are 2½ in. wide by ¾ in. thick, as shown at C (Figs. 1 and 2). In putting together the wheel, the spokes are driven in, tongued down to take the felloes, which, after being cleaned off, are ready for the tyres.

Softening Water.—The temporary hardness of water is due to the presence of calcic and magnesic carbonates, and one method of overcoming it is by boiling, which expels the carbonic acid and precipitates the carbonates. Permanent hardness is due to calcic and magnesic sulphates, which boiling does not affect. Hard water will not dissolve soap, but precipitates it, hence the soap test is now usually employed for determining the hardness of water. Every grain of calcic carbonate or its equivalent in 1 gal. of water constitutes 1 degree of hardness.

Soap-tableting Machines.—Soap-tableting machines are made either for hand or power work, but the former are more often used; they are simply lever presses with reversing springs, and are provided with dies for producing the shape and impression. The soap tablets are cut to shape first before being placed on the die of the machine.

Restoring Colour of Varnished Oak Gates.—An efficient method of restoring discoloured oak woodwork has not yet been discovered. If, however, the mischief is confined to only a few places, a suitably coloured stain or dye might be used with advantage; but this course is only advised if the patches are of definite outline, and the rest of the woodwork is of a uniform tone not much the worse for wear. On the other hand, if the work is bad all over, owing to the use of originally poor varnish or neglect of revarnishing in time, all traces of existing varnish should be entirely removed with scrapers or by means of a chemical stripper, and the whole of the woodwork brought up to a new surface (using plane, scraper, and glasspaper); then size and varnish in the usual way. The bleached marks do not penetrate deeply into the wood, and a very slight surfacing is all that is required in order to regain the natural colour of the wood. The result also will be more satisfactory than any "faking" of the bad parts could produce. Aldridge's best outside copal oak varnish will be suitable.

Flower Pot Ladder.—For the expanding flower pot ladder (Fig. 1) obtain four 24-in. pieces and four 9½-in. pieces of iron. Punch a hole in the centre of each 24-in. piece, and one 6 in. from the end of each 9½-in. piece. Having riveted the pieces together, the uprights

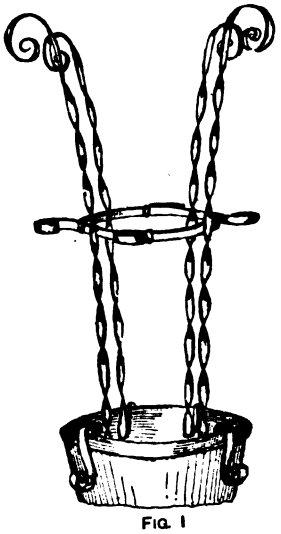


FIG. 1

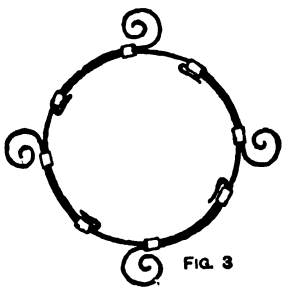


FIG. 3

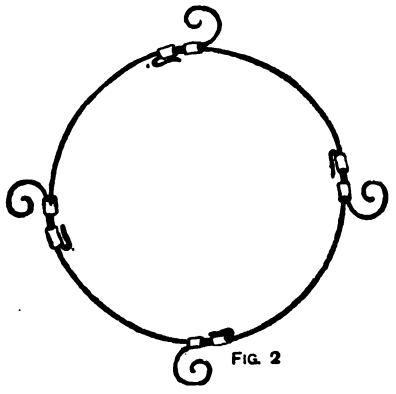


FIG. 2

Flower Pot Ladder.

can be curled or left plain as preferred. The running joints must be left so as to move with a little pull. In turning up the end to fit on the pot, leave at least 1 in. inside the pot; then turn down. The extreme end can be turned with a scroll or left with a hook. In working these designs, leave the ends of strips round to soften the effect. Fig. 2 is a plan of the centre ring, open, while Fig. 3 shows it closed.

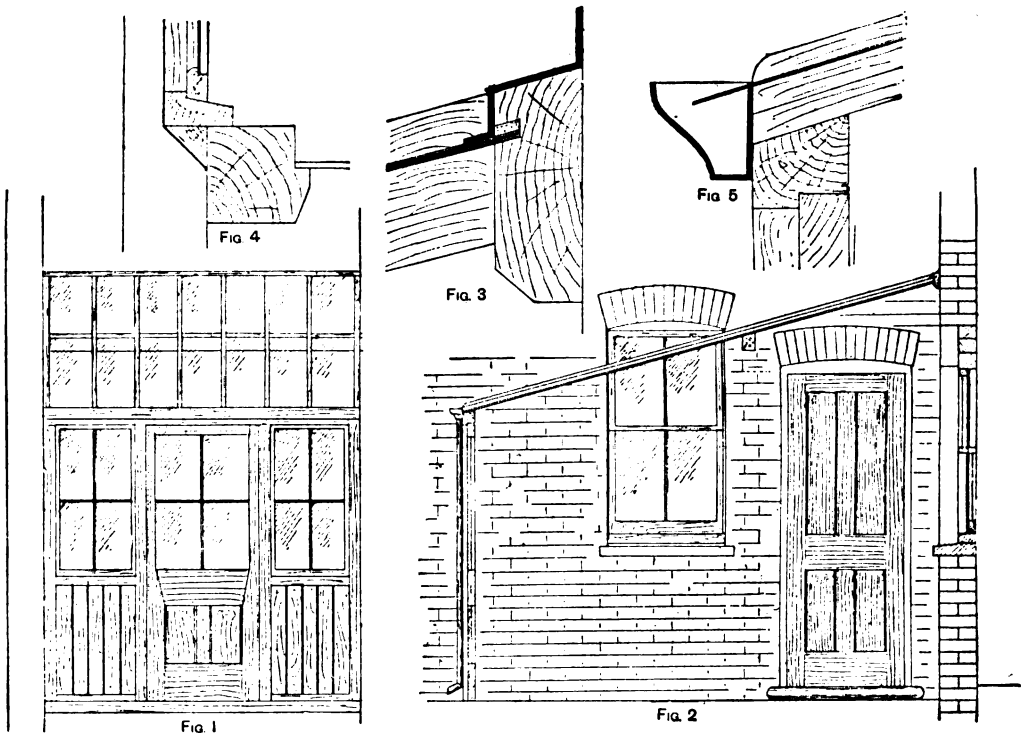
Revarnishing Violoncello.—A violoncello is but rarely French polished; the usual medium for violoncellos is a spirit varnish finish, the requisite tint being gained by colour incorporated with the varnish in preference to staining. It is a rather difficult job to match the colour if left on in patches. More satisfaction is assured if a clean surface is worked on by removing the old varnish off the whole of the portion that has been repaired. Then proceed as follows. Dilute 3 parts of good quality copal varnish with 1 part turpentine, and set aside in an oven till quite hot; then apply to the bare wood, using a bristle brush. It acts as a grain filler, but to avoid the use of glasspaper again, any excess should be at once removed by a pad of wadding secured in a covering of soft rag; moisten this with turpentine, and apply to the varnished surface before it has had time to harden. The surface, when quite hard (say in two hours), is ready for spirit varnish, which is made by dissolving 2 oz. of bleached shellac, 2 oz. of gum sandarach, and 2 oz. of Venice turpentine in ½ pt. of methylated spirit, the requisite colour being given to it by extracts of red sanders wood and turmeric; 2 oz. of each should be steeped in separate bottles, each containing ½ pt. of spirit. Then, by adding small quantities of each to the varnish in varying proportions, an amber or a red tone, as may be required, will be gained. The varnish, when stained, should be strained, and should be applied by a camel-hair brush. Lay it on from end to end to avoid patchiness, applying several coats if necessary; but remember that each coat makes the varnish so much darker or richer in colour. Though the varnish dries rapidly, one coat should be laid on daily to enable the under coat to harden thoroughly. As the surface thus built up would have an objectionable glarish appearance, it should be allowed to stand at least two days; then the varnish may be dulled down by rubbing with fine grade pumicestone powder and water, the surface being brought up again by rubbing with crocus or rouge and linseed oil, finishing off with the palm of the hand and flour. If only a semi-lustrous finish is desired, it will generally suffice if, after the varnished surface has been dulled, a rag slightly damp with spirit and linseed oil is lightly and briskly rubbed over it in a straight direction.

Obtaining Gelatine and Fat from Bones.—The bones should be chopped or broken as small as possible, then placed in a pan with sufficient water to cover them and boiled for several hours. The water should be made up from time to time as it evaporates. The liquid should then be strained from the bones and allowed to cool, when the fat may be removed as a solid cake from the surface. The liquid containing the gelatine should be evaporated to dryness as quickly as possible in a shallow dish on a water bath. Gelatine made from bones is not of very good quality, and working on a small scale it will be certain to be turbid, as filtering could not be carried on without pressure. When made on the large scale the bones are heated with water under pressure in a closed boiler; more gelatine is obtained in this way, and the solution is filtered either by using the pressure exerted by a column of the liquid or by filter presses.

Painting Croquet Balls.—A paint that has been much used successfully for croquet balls is made by thinning white-lead ground in oil with equal parts of raw oil, thickened oil, and turpentine. Give the balls two coats of this paint, allowing four days to harden after each coat, and finish with two coats of hard-drying body varnish. The thickened oil imparts elasticity to the paint and prevents chipping off. Another method is to apply two coats of thick celluloid varnish over the paint, or apply a colour coat by mixing zinc white with celluloid varnish. This forms an excellent protection for the balls against hard wear and moisture, and will not crack as do most other varnishes. Use the zinc white in dry powder, not in oil.

Elastic Paint for Collapsible Boat.—Below is a recipe for a slate colour paint that will not crack, suitable for a canvas collapsible boat to be used on salt water. The canvas should be allowed to dry thoroughly in a warm room. Then apply two coats of double-boiled Baltic linseed oil, the oil for the first coat to be slightly warmed, so that it will penetrate into the canvas. When thoroughly dry, apply two coats of composition made as follows. Dissolve ¼ oz. of pure rubber (caoutchouc) in ½ pt. of solvent naphtha (coal-tar naphtha), and mix with 1 pt. of boiled Baltic linseed oil and ½ pt. of oak varnish. Mix all well together, and use as a medium for mixing some powdered graphite to the consistency of ordinary paint; a little white-lead paste paint may be added to produce the slate colour. This forms an admirable preservative against the action of salt water, and is quite flexible and durable, and dries with a glossy surface if prepared from copal or carriage varnish. The graphite (blacklead) used in the preparation affords excellent protection against weeds adhering to the bottom of the boat, and also accelerates the speed of the craft.

Roofing-in Back Yard.—Figs. 1 and 2 are elevation and section of a roof and front framing in a yard situated between two brick walls at the rear of a house. The front framing consists of 3-in. posts and rails, with 1½-in. sashes at the side and 1½-in half glass doors. Below the subsill is ¾-in. beaded matching. The skylight is composed of 2½-in. by 2-in. rebated and chamfered bars, tenoned at the upper ends into a 4½-in. by 1½-in. wall plate (see Fig. 3); the lower ends of the bars rest on the splayed head of the front framing. The bars are cut off in a vertical line with the framing below, and the glass runs past the end 1½ in. Along the front is fixed a moulded iron gutter covering the ends of the bars, the water being carried away by a pipe with a shoe discharging over or near a yard gully. The bars next the wall are single rebated and chamfered, and are fixed to wood plugs driven into the joints of the brickwork; the bar next the scullery window is fixed in the same manner, as near the centre as possible. A purlin 4½ in. by 3 in. is fixed underneath the bars and tailed into the wall at each end to support the roof. A small spandril sash and frame will be required to fill up the space above the roof and the arch to the window; this might be fixed, but as ventilation is required it will be better if made to open in a light frame with a sill (see Fig. 4). The whole of the work should be glazed with 21 oz. clear sheet glass, unless obscure glass is preferred, when white Muranese would be most suitable. The roof light should be glazed as follows. First give the rebates and all parts of the bars a coat of good red-lead and oil colour. When dry, run along the rebates a layer of putty, not too stiff, to form a bed for the glass; lay the glass in place, pressing it down to the putty by rubbing the fingers along the edge. When the glass is firmly bedded, drive some sprigs along the edges to keep the glass in place, after which the glass and wood in the rebate should be given several coats of good paint; no back putty should be used. Fig. 5 is a detail of the eaves guttering.



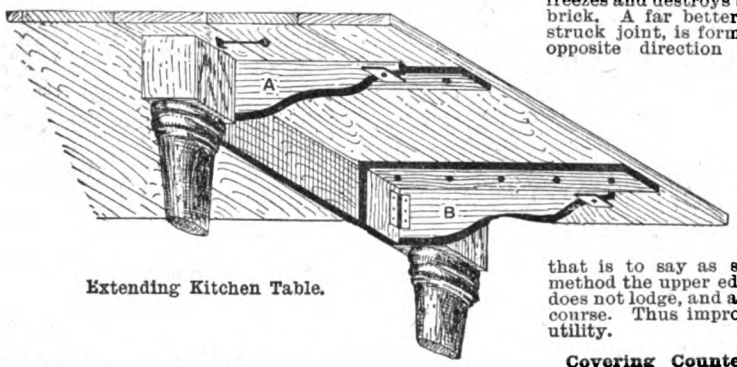
Roofing-in Back Yard.

Dyeing Veneers.—Dyeing veneers must not be confounded with staining veneers. The latter in most cases stains the woods sufficiently deep for French polishing, but it is a usual plan, as they do not always strike deeply into the woods, to apply the stains after the articles are made and cleaned up ready for polishing. To be successful in dyeing veneers so that the colours will penetrate right through, or to such a depth as will enable the veneers when "laid" to be cleaned ready for polishing without disturbing the colours requires an intimate knowledge of the characteristics of the woods employed, and of the action of the chemicals and mordants. Thus some mordants have a chemical affinity for certain colouring pigments, whilst on others they may have an opposite effect. The usual method is to employ the mordant first, but sometimes the order is reversed. In any case, the colouring matter will more readily strike in if the veneers are quite damp, and after the staining gradual dyeing should be the rule, rather than hasty dyeing, to enable the veneers to be immediately used. If an iron tank can be used with a steam jet to keep the contents boiling, the dyes will have far greater penetrating power. The chief mordants for use in this work are obtained from iron, tin, copper, aluminium, and potash soda, whilst the colouring substances include vegetable roots, and barks and berries, with acids and anilines. For the purpose of experiment the following details are given. *Brown.*—Mordants: Bichromate of potash, permanganate of potash, sulphate of aniline, or alum. Brown colour being gained by a combination of red, blue, and yellow, any of the products of the vegetable kingdom yielding these colours may be used in varying quantities; on the other hand, bichromate of potash, permanganate of potash as mordants, with sulphate of aniline as a colour agent, will give several shades of brown, or after the mordant has been used, a weak solution of aquafortis or oil of vitriol may be tried, which, however, gives a rather scorched or burnt appearance. *Mahogany.*—Madder root and extract of logwood should be used for colouring purposes, with pearlash as a mordant. Carmine, Brazil wood, dragon's blood, alkanet root, madder, red sanders, and logwood also give varying shades of red. *Yellow.*—Use turmeric, saffron, fustic, gamboge, and barberry root, with pearlash or potash as mordants. *Green.*—Use sulphuric acid and pearlash with arsenic, or acetate of copper on dyes of blue and yellow; also verdigris dissolved in acetic acid. *Blue.*—Use indigo with vitriol. *Black.*—Use extract of logwood with acetate of iron, which is made by steeping rusty iron in common vinegar.

Honey Soap.—Honey soap may be made by adding to 40 lb. of white curd soap 3½ oz. of citronella oil, 2½ oz. of lemon grass oil, and a small quantity of aniline yellow The method of making, is described in a paragraph on making carbolic soap on p. 116.

Refuse Destructor.—Excluding ashes, the ordinary refuse from a small establishment may best be destroyed by burning it in the kitchen fire. This applies to vegetable refuse, fish heads, and such like. Garden rubbish is usually burnt in a heap in the garden. If circumstances make this undesirable, a simple brick firegrate should be built, with a closed iron door and as long a flue as possible, for the chief essential is a good draught. A grate 12 in. square will probably be large enough; it must be arched over, and at the back a sloping hearth should be constructed, with an iron door over it through which the refuse can be thrown. The refuse is thus submitted to a drying process on this back hearth and is afterwards raked forward on to the fire. All the heated gases from the fire must travel backwards over the sloping hearth on their way to the flue, which should be carried up the gable of some building to the greatest height possible. Air is admitted to the furnace only through the fire bars. If the draught is good enough, the refuse may be made to burn without the addition of any other fuel.

Extending Kitchen Table.—The following are particulars of a method of extending a kitchen table. A leaf is made of two boards, each 3 ft. by 9 in. by 1 in., fastened together with dowel pins, and two 3-in. battens are screwed on underneath, these extending beyond at one end of the leaf by 2 in. so as to fit under the overlap of the table top. On the end of the table two wood brackets A and B (see the illustration) cut from 1-in. board are hinged. Before screwing one of the brackets to the table, a piece 4 in. by 2 in. by 1 in. is screwed on to

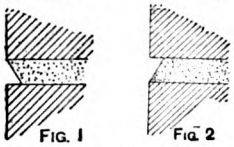


Extending Kitchen Table.

raise the bracket so that it overlaps the other bracket when closed up. The battens are fixed so as to slide between the brackets to keep them open, and two wood turnbuttons are screwed on the battens at each end, and when turned round hold the top to the brackets, thus preventing the top being tilted. Two iron hooks and eyes are screwed to the leaf and table top, and keep the leaf from being dislodged. When the leaf is not required, it can easily be removed and put on one side and the brackets turned back, these being hidden when the tablecloth is on.

Comparing Samples of Coal.—In comparing the merits of different samples of coal from analyses it is essential to know whether the coal is intended to be used as a steam or as a gas coal, as there is a distinct difference between the two descriptions. This will be best explained by means of the accompanying analyses of a gas and a steam coal respectively. Steam coal: carbon, 90·12; hydrogen, 4·33; nitrogen, 1; sulphur, 0·85; oxygen, 2·02; ash, 1·68; and coke, 86·53. Gas coal: carbon, 82·24; hydrogen, 5·42; nitrogen, 1·61; sulphur, 1·35; oxygen, 6·44; ash, 2·94; and coke, 35·6. It will be seen that the steam coal contains a larger amount of carbon than the gas coal, and that this carbon exists to the extent of 86 per cent. in the fixed form as coke, and this is what is required in a steam coal; but in the case of a gas coal the carbon is required to be associated with hydrogen in the form of volatile carbon, so that in a good gas coal only 35 per cent. of the carbon exists as coke, the remainder being driven off in distillation, but this description of coal would not be so well adapted as a steam coal by reason of the volatile carbon producing large quantities of smoke. One piece of information relative to the value of a coal for gas-making purposes is afforded by an elementary analysis, viz. the percentage of unoxidised hydrogen, by which is meant hydrogen unaccompanied by an equivalent of oxygen, which is obtained by deducting one-eighth of the percentage of oxygen from the percentage of hydrogen. It is usually understood that coal is very poor for gas-making purposes when the unoxidised hydrogen is less than 4 per cent., and it is exceedingly rich when the unoxidised hydrogen exceeds 5 per cent. The reason why the percentage of unoxidised hydrogen plays such an important part in the choice of a gas coal is that when the coal is distilled, every 16 parts of oxygen unite with 2 parts of hydrogen to form 18 parts of water, leaving only the hydrogen over and above that required by the oxygen for the production of hydrocarbons. From these facts it will be seen that the choice of a steam coal depends largely on the amount of fixed carbon it contains, while a gas coal requires a good proportion of volatile matters, and over 4 per cent. of unoxidised hydrogen, and the sulphur and ash in both descriptions should be as low as possible. With regard to the loss of coal when left for a time in the open air, the information on this point is not very conclusive, but it is usually assumed that in the presence of moisture, which is the condition prevailing when coal is stored in the open air, the sulphur of the iron pyrites undergoes oxidisation; this results in a rise of temperature sufficiently high to distil the coal partially, and thus drive off some of the hydrogen and carbon, the coal consequently losing a portion of these elements.

Weather-struck Joint.—Fig. 1 shows a form of weather-struck joint which, unfortunately, is very common and is ignorantly made with the idea of improving the appearance of a building by means of the sharp lines of the upper edge of the bricks; however, as a shadow is not formed, the effect is lost at a very short distance; and the disadvantage of this joint is that a ledge is formed on which water lodges, and in winter freezes and destroys the joint and the upper edge of the brick. A far better joint, properly termed a weather-struck joint, is formed by striking the mortar in the opposite direction to that illustrated in Fig. 1,



Weather-struck Joint.

that is to say as shown in Fig. 2. By this latter method the upper edge of the brick is protected, water does not lodge, and a sharp shadow is presented at every course. Thus improved appearance is combined with utility.

Covering Counter Top with Zinc.—When first cutting the sheet zinc for covering a counter top, make the width of the metal about 1 in. greater than the counter. If the sheet does not rest flat, take each of the corners alternately, and pull them over in a broad curve across the diagonal of the sheet, and let each in turn spring back; this usually renders the sheet pretty flat. Then bend down at right angles ½ in. along each long edge of the sheet, so that these edges will lap over and fit tightly to the wood top. Also countersink one end of the sheet for forming a flush lap joint; where each of these joints occurs the wood must be cut away, so that the countersunk seam will rest flush in the groove. Then place each piece in position, and float the solder across at each lap seam. Now cut some strips of zinc 1½ in. wider than the depth or thickness of the wood top, and fold each of these strips to a right angle, the base being 1½ in. Fit these so that the lower part laps underneath the wood top, and the top edge is level with the counter top. Solder the top edge of these strips to the flat top already in position. On the under side of the strip, ordinary tin tacks about 9 in. apart, driven through small holes in the zinc into the wood, will render it secure. Next remove all the surplus solder from the top outside edges with a float, rub down quite smooth with fine emery cloth, and finish off the edge quite bright with a burnisher. The spare solder on the top cross seams is removed with a sharp scraper, and afterwards rubbed down as above. To clean the zinc, mix a little raw spirits with some fine sand, and scour the metal a little at a time with this, and then quickly rinse the acid off quite clean with cold water. After the whole of the metal has been scoured in this way, dust some whiting over it and polish with a clean dry cloth.

Verge Watch Stopping when on its Back.—The cause of a verge watch not going when lying on its back may be that the top verge pivot may be bent, the pivot hole may need bushing, the balance may foul the balance cock, or the hairspring may foul the balance. Hold the watch movement in the position in which it stops, and carefully observe all these things.

Grinding Circular-saw Teeth.—The following are instructions on grinding a circular saw so that the teeth will be of equal widths and at equal distances apart. To keep the space equal from point to point of the teeth, each tooth must have an equal amount of grinding on the face. The saw should be placed on the saw spindle and set running. While the saw is revolving, cut into a piece of wood as shown at A (Fig. 1); then place a piece of medium hard grindstone B on the wood, and bring the stone gently towards the saw teeth so as to grind off the points. The stone must be held firmly with both hands while the grinding is being done. After the teeth have been ground, remove the saw from the spindle and place it under the emery-wheel. In Fig. 2 the faces of the teeth C are well ground back, while the faces of D are only lightly wiped with the emery-wheel. The gullet in each case should be kept to a uniform depth. In Fig. 3 the backs of teeth E and faces F should be well ground, while the backs G and the faces of E should only be very lightly ground. After each grinding with the emery-wheel, the teeth whose faces have been ground back

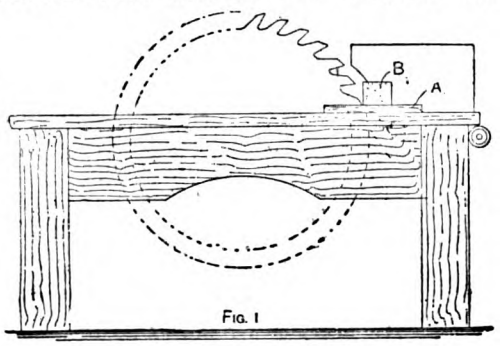


Fig. 1

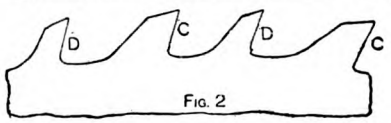


Fig. 2

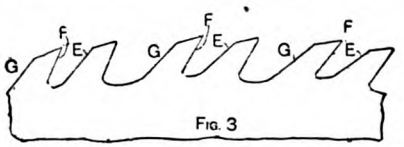


Fig. 3

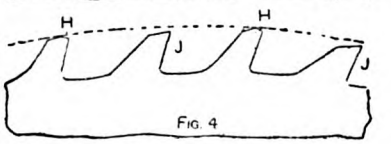


Fig. 4

Grinding Circular-saw Teeth.

will be found to be low, as at J (Fig. 4). The saw is again put on the saw spindle, and the high teeth are ground down as shown at J (Fig. 4). This figure represents the teeth shown at Fig. 2 after they have been once under the action of the emery-wheel. The tops of the teeth H are filed with a topping-file until the flat places caused by the grindstone disappear, when the saw is again set running, and the points of the teeth are ground off by the method shown in Fig. 1, after which the teeth are brought under the emery-wheel and treated as before. After being thus treated a few times the teeth will become equally spaced and, if properly run down and carefully topped, the saw will be perfectly round.

Paper Balloons.—The following are directions for making paper balloons. First draw an elevation of the balloon it is intended to make, either full size, on the floor, or to scale. The shape here illustrated differs slightly from that of balloons usually sold ready made, being wider at the mouth. This shape, however, is not so liable to catch fire when swayed about by the wind. Divide the elevation into any number of parts (the more the better) by horizontal lines as shown in Fig. 1. Take the radius of the balloon on each line as A B, describe circles (Fig. 2), and divide these into twelve parts by radial lines. Then to make a pattern, draw a perpendicular (Fig. 3), with horizontal lines at the distances of the horizontal lines in Fig. 1, but measured on the circumference as C D. Then set off on each line from the perpendicular half the distance between the radius lines (Fig. 2) on the corresponding circle as E F, and draw a line through the points thus found, and the result will be the shape of each section. Allow a little (say ¼ in.) on one side when cutting out for pasting. Each section will be made up of one, two, or three pieces, according to the size of the balloon to be made. If the pieces are cut as shown in Fig. 4, a great saving of paper results. To paste these pieces together, place them in a pile on the table or bench with the edges flush and a piece of waste paper under the pile. Now rub the top sheet with the thumb nail until each piece is moved back from the one immediately under it about ¼ in. Place a piece of waste paper about the same distance from the edge of the top sheet,

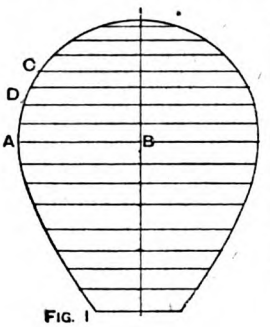


Fig. 1

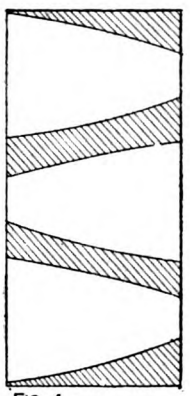


Fig. 4

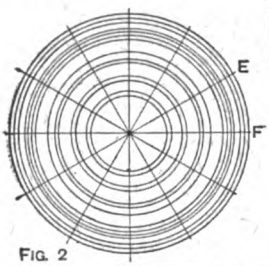


Fig. 2

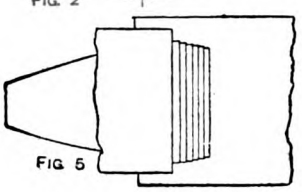


Fig. 5

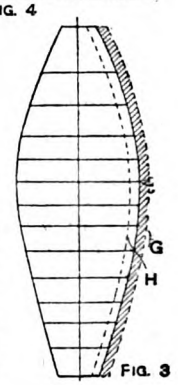


Fig. 3

Paper Balloons.

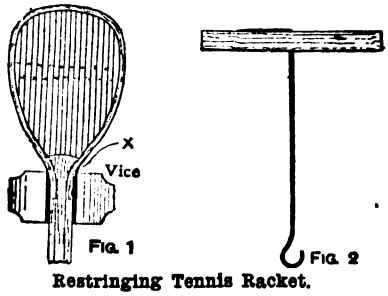
and pass the paste-brush over the whole of the exposed edges. Fig. 5 will explain what is meant. Now place two of the completed sections together so as to look like Fig. 3, with a small part projecting as shown by the dotted line G. Paste the edge of the under section—that is, the part hatched—and turn it over on to the dotted line H. When each two of the sections have been joined in this way, proceed in the same manner to join these together till the whole is complete. A circular piece of paper is cut out to join the sections at the top, and a loop of string should be pasted to the top to suspend the balloon whilst inflating. A ring of wire with two cross pieces is fitted to the bottom of the balloon, and the inflammable material—tow soaked in methylated spirit—is fastened at the junction of the cross pieces.

Rose Soap.—Scented soaps are usually made from good white curd soap, which is cut into flakes by machinery, partly dried on trays, then heated in steam jacketed pans till pasty, when the scent is stirred in. The soap is then rolled into bars of the desired shape, and cut into tablets; these are compressed and then stamped in hand presses with dies. The quantities of materials for 40 lb. of rose soap are oil of rose geranium 1⅜ oz., tincture of musk ½ oz., and tincture of bergamot 1¾ oz.

Cutting Hole in Porcelain or Fire-clay Bath.—The so-called porcelain bath is really made of fire-clay, and has a porcelain enamelled surface. The holes in such baths are not drilled, but are cut and countersunk with a hammer and small sharp chisel in the same manner as a mason would cut a hole through a stone slab. Great care is required in cutting such a hole, which should be large enough to allow for the expansion of the brass overflow connection whenever it becomes heated. Many baths are ruined by neglect of this latter precaution. When ordering new baths, it is advisable to let the makers cut all necessary holes.

Pliable Composition for Comical Faces.—A cheap and suitable composition for an elastic composition that may be used for making comical faces such as are sold in the streets may be made from glue 6 oz., water 26½ oz., glycerine 26½ oz., sugar 6 oz., barytes 15 oz., and sufficient venetian red to give a pink tint. Soak the glue in the water, melt down by heat, stir in the glycerine, then the sugar, finally the barytes and venetian red, and mould while the mixture is fluid.

Restringing Tennis Racket.—A small bench vice with 3-in. or 4-in. jaws will be strong enough for use in stringing rackets. Put a piece of soft thick leather on each side of the tennis bat. The jaws of the vice must hold the bat right up to the shoulders (see Fig. 1), or when pulling on the string the bat will break at the part marked X. When the main strings are tightly threaded down in the vice, tighten from the middle string of the racket, using for the purpose a steel button-hook fixed in a wooden handle (see Fig. 2). Suppose, for example, the bat has eighteen strings (that is, nine on each side), pull first with the button-hook on No. 9, and hold the string with the left hand while No. 8 is pulled, then hold No. 8 while No. 7 is pulled, and so on down to No. 1. The bare end of No. 1 has already been passed beneath the loops of Nos. 5 to 1, and the slack must now be pulled



Restringing Tennis Racket.

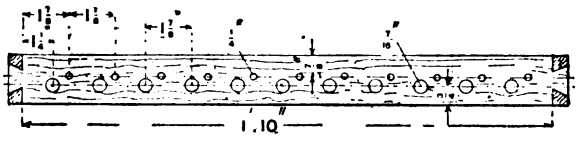
through the loops with blunt pliers, No. 1 being held as Nos. 9 to 2 were held until the slack is pulled tight. Treat the other side (strings 9 to 1) in the same way, the sides being pulled to about the same tension, to keep the bat in shape, and a support being provided to keep the head from being pulled down. When the main strings are tight and musical like a harp, work the cross strings in over and under each main string. Before this, however, go over the main strings again, and bring them to the same tension as before, using the button-hook and fingers in the manner already described. The main strings may have to be gone over half-a-dozen times before the right tension everywhere is obtained, and the strings finally fastened off. A pad of soft cowhide leather 2 in. wide, with a hole in it for the thumb, can be used to protect the hand when pulling on the strings.

Cause of Blue Deposit in Electro-tinning.—The cause of an electro-tinning solution giving a blue deposit of tin is probably a deficiency of tin in the solution. The deposit is thin and poor, and the coat is put on, under strained conditions, hence its blue appearance. Tin solutions rarely feed themselves automatically from the anodes. It is, therefore, necessary to keep up their metal strength by adding some concentrated tin solution to the bath from time to time, or to arrange a reservoir of the feeding solution with a gradual but small leakage into the working solution.

Preventing Treacle Toffee becoming Moist.—Treacle toffee is most liable to soften by absorbing moisture from the air, and this cannot be prevented except by keeping the toffee in closed bottles or tins. It will be best to make the toffee principally from white sugar, colouring and flavouring it by the addition of a small quantity of brown treacle. The sugar and treacle should be placed in a pan with a little water and a pinch of cream of tartar, and heated to "hard crack"—that is to say, until a piece taken out and cooled breaks with a snap. When this point is reached, the butter may be stirred in and the toffee moulded. The cream of tartar prevents the crystallisation of the sugar, and, as there is not much treacle present, the tendency to become sticky will not be so great.

Waterproofing Paper.—For waterproofing and air-proofing paper, dissolve 1½ lb. of white soap in 1 qt. of water. In another quart of water dissolve 1½ oz. of gum arabic and 5 oz. of glue. Mix the two solutions, warm them, soak the paper in the liquid, then pass the paper between rollers, or merely hang it up to dry. Another recipe is as follows. On a table lay a quire of paper, open it out flat, and rapidly iron it with a very hot iron against which is held a piece of wax; this, melting, runs down on the paper and is absorbed by it. There is no waste, as the wax that is not absorbed by the top sheet runs through to the next.

Egg Turner for Incubator Drawer.—The accompanying illustration shows an independent turner which turns one row of eggs in an incubator at a time; this turner will be of the greatest convenience when eggs are chipping, as those eggs should be placed chip upwards and allowed to remain so until hatching takes place. One important point in the construction of this turner is that the holes in the back and front of the drawer frame should be exactly opposite each other; in order to ensure this, screw the back and front of the frame together and bore both at the same time, then set the holes out on the front piece. This drawer frame should be made of sound deal, ½ in. thick, 2 in. deep, and 22 in. inside; this size will accommodate twelve rollers, and each roller will hold nine hens eggs placed end to end, so that a hundred and eight eggs can be turned in a quarter of a minute. The roller holes are bored with a ⅞-in. twist bit, in order to allow a ¼-in. rod to run easily. The first hole should be bored 1½ in. from the inside of the drawer frame, and ¾ in. from the bottom of the frame; the remainder of the roller holes should be 1¾ in. apart from centre to centre. The ends of these rollers should be allowed to project ½ in. through the drawer front, and a 1-in. wooden knob glued on the end of each roller, so that the eggs may be turned without opening the drawer. These rollers are procurable at any oilshop, and are sold as plant sticks;



Egg Turner for Incubator Drawer.

they are of foreign wood, very hard, and will stand a warm, damp atmosphere. The knobs have a wooden screw, and when this screw is removed the knobs can be fitted to the roller ends. (After removing the screw, run in the ⅞-in. bit in order to cut the thread out, and the knob will then fit the ½-in. roller.) The small holes should be bored with a ¼-in. twist bit, the first hole being bored 1½ in. from the inside of the drawer frame and ¾ in. from the top of the frame; bore these holes 1¾ in. apart. The best rods for the purpose are stair rods, as the surface is perfectly smooth and allows the egg to slip freely when the roller is turned. The garden sticks used for the rollers will be found a little rough, thus gripping the egg and turning it.

Bonfire.—In building a bonfire, place the most combustible materials, shavings, boxes, tar-barrels, etc., in the centre. Then arrange one or two rows of barrels or large timbers in such a way as to make flues leading from the outer edge of the pile to the centre, and build the heavier timbers over these in a conical heap. One or two tar-barrels or a few gallons of paraffin thrown on the heap will ensure its burning. Leave the flues clear, and light up by means of a long stick shoved up one of the flues to the shavings and chips in the centre.

Hydrogen Peroxide.—One method of preparing hydrogen peroxide is as follows. Barium peroxide is suspended in water and just sufficient sulphuric acid added to combine with the whole of the barium, the hydrogen peroxide formed remaining dissolved in the water. A ten-volume solution will yield ten times its volume of oxygen on heating, and to prepare it the following details have to be taken into account: 169 grammes of barium dioxide and 98 grammes of sulphuric acid yield 34 grammes of hydrogen peroxide, and 34 grammes of hydrogen peroxide yield 16 grammes of oxygen or 11·2 litres, and to form a ten-volume solution 1·1 litre of water would be required. The quantities to take are, therefore, 169 grammes of barium peroxide suspended in 1·1 litre of water, and 98 grammes of sulphuric acid very gradually added during cooling and shaking. See also Series I., p. 306.

Grinding and Polishing Bevel Edges on Plate Glass.—Below are hints on grinding and polishing bevel-edge plate-glass circles. The circle should be embedded in plaster-of-Paris on a circular plate, rather larger than the largest plate to be bevelled, and should revolve on an iron rod below as support, the iron rod sliding in a bearing on the lathe, and being gripped at the proper height by a screw. The iron plate is fixed horizontally, and the wheel or grinding disc is set at the proper angle to produce the ½-in. or ¾-in. bevel required. The grinding disc is of steel, and is moistened with water and fine sand. The iron plate holding the circle is moved up till the edge of the glass just touches the face of the grinding disc, which is then caused to revolve, and as the disc grinds the edge of the glass away, the support is revolved until the whole of the edge is ground off; then the iron plate is moved up again and a further portion of glass is removed, and this operation is continued until the bevel is formed, only that portion (about $\frac{1}{16}$ in.) embedded in the plaster being left unground. After grinding, fine emery is used to remove the scratches made by the sand, and then the bevel is successively polished with flour emery, crocus, or rouge, and putty powder, discs of wood, wood covered with leather, and, lastly, wood covered with felt.

Chuck for Wood-boring.—True boring may be done with a chuck as shown in Figs. 1 and 2. The chuck is capable of adjustment to hold round or square work of any reasonable size. The height of the angles A must of course be equal to the height of the mandrel. The jaws of the chuck are closed by a right- and left-handed screw,

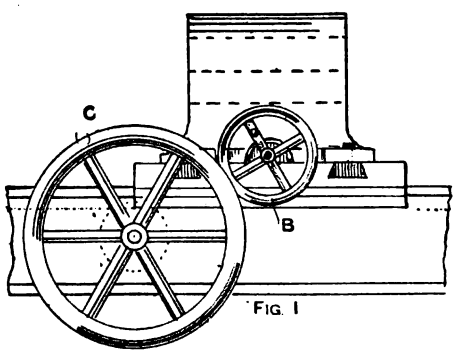


FIG. 1

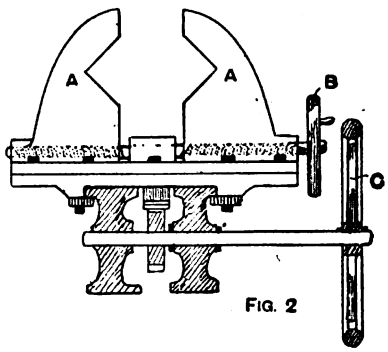


FIG. 2

Chuck for Wood-boring.

operated by the small wheel B, while the work is advanced to or receded from the boring bit by a rack-and-pinion movement controlled by the large wheel C. Illustrated instructions on boring bits and special reaming tools well adapted for conical boring appear on p. 118.

Alloying Lead and Zinc.—Lead and zinc do not alloy well together. Even when melted and well stirred in the melting-pot they will again separate if allowed to remain quiet. When melted, then well stirred and poured into a casting mould, they will partially separate before they have time to solidify. The zinc will rise to the surface, as it is the lighter metal, the specific gravity being 7·146, and the lead will sink to the bottom, as it is heavier, the specific gravity being 11·36. Castings made of a mixture of lead and zinc are never satisfactory, and there is no flux that will make them alloy well together, although the addition of a little arsenic has been suggested as an aid.

Carbonate of Soda as Washing Powder.—The ordinary pure carbonate of soda, which is mild in its action, will do much more work than the ordinary washing soda, and does not froth like the washing powders. A very fine carbonate of soda, known as the "sesquicarbonate," is made for this purpose and is in the form of a fine crystalline powder and dissolves readily in water.

Heating Greenhouse.—For a greenhouse without forcing frames the Loughborough type of boiler is good. It is made and sold complete with pipes and parts for simple fixing. Forcing frames fixed along one side of the house usually are heated by two 2-in. pipes run through the frames. The pipes may be 3 in., or even 4 in., according to the purpose for which the frames are required. The large pipes are used when the frames are similar to melon pits. The frames are usually at a little lower level than the greenhouse, and this makes the use of a Loughborough pattern boiler impossible unless it is sunk about 12 in. in the ground. No objection can be urged against so sinking the boiler, and it is even then much less expensive and troublesome in fixing than a saddle boiler. If the Loughborough boiler is not adopted, the saddle boiler is the one that should be used. This boiler must be fixed in a covered pit below the level of the greenhouse. For a greenhouse, allow 32-ft. run of 4-in. pipe per thousand cubic feet of space in the house. For a cool house, 25 ft. per thousand, or an equivalent length of smaller pipe, will do. For 3-in. pipe add one-third, for 2-in. pipe double the length.

Number of Slates Required in Roofing.—The number of squares of 100 ft. sup. should be taken from the bill of quantities or determined as follows. Take from the section the distance up the slope and multiply this distance by the length along two or four sides as the case may be, the quantity for a hipped or gabled roof being the same. Deduct the space occupied by chimney, skylights, traps, dormers, etc., and add the length by 6 in. for waste in cutting around all deductions. Add length by 6 in. on each side for waste in cutting to hips, valleys, and irregular gables. No allowance for square gables or ridge. Allow length by gauge or margin for waste on doubling course at eaves and curb. Total this up to arrive at the amount inserted in the bill of quantities. Then according to the size of slate and margin shown will be the covering power of each. For example, countess slates 20 in. by 10 in. centre nailed, with 3 in. lap, the gauge will be 8½ in. and the exposed surface 10 × 8½ = 85 sq. in., and if the roof contains 8 squares = 800 sq. ft. the number of slates will be $800 \div \frac{85}{144} = \frac{800 \times 144}{85} = 1356$.

Material for Setting Gauged Brickwork.—Brickwork that is to be carved should be set in a mixture of shellac varnish and white-lead ground in oil, the two materials being well mixed and knocked together. This mixture sets firm in a few hours, and eventually becomes so hard that if bricks bedded with it are separated the bed will tear away with it a portion of the brick. Lime putty should never be used for work that is to be carved, for at the first blow of the carver's tool the bricks would move on their bed, as the lime does not set, but simply dries, and remains soft and friable. Lime putty, however, is used for setting gauged work in general, and answers the purpose well. It is prepared in precisely the same way as plasterer's putty. The lime is slaked and run through a sieve to remove lumps and impurities, and is used for setting in a liquid state. Mason's setting material for stonework is made of slaked lime and stonedust.

Cementing Tiles to Iron.—If the iron surface is any part of hot apparatus, the tiles cannot be made to adhere satisfactorily whatever cement is used, and the only good means of fixing the tiles is to drill and tap holes in the plate to receive screws at the corners of the tiles. Suitable screws with washers can be readily obtained. The screw does not go through the tiles, but comes outside the extreme angle, so that one screw and washer will cover and secure a corner of four tiles where they meet. If the iron surface is always cold, then probably red- and white-lead will prove as good as anything. Mix moist white-lead and dry red lead to the consistency of very soft putty. Thin a small portion with boiled oil to paint consistency, and with it paint the surface of the iron and the backs of the tiles. Now spread a thin layer of the lead putty on the back of a tile, and press it firmly on to the iron surface; the tile will adhere at once. The work will dry and set hard in a few days.

Fixing High Flagstaff.—It is not considered advisable to fix a flagstaff either in concrete or in soil. If the ground is soft, get five large stones, say 3 ft. 6 in. by 3 ft. 6 in. by 1 ft. 3 in., well bedded in the ground. Drill holes through the centre of each, and fix ¾-in. eye-bolts with nut and washer, fixing one in the centre and one at each angle. Fix at the lower end of the mast a 2½-in. by ¼-in. band with double eyes and a bolt to go through them and through the one already fixed in the centre stone, thus forming a hinge to the mast. Have also a band at the top of the mast, with four eyes riveted or threaded to the band, each pointing to each corner stone. Fasten the guy to these while the pole is down on the ground; get the length of the guys, and fasten a screw coupling to the end of each guy. Hinge the mast to the eye-bolts in the centre stone, and hoist up; hook the guys to the corner stones, and tighten with the coupling to bring the mast upright. The use of wire guys is advised. If the site is rock, drill holes about 12 in. deep, and fix eye-bolts in with lead or concrete, having the bolts fixed in the concrete.

Artillery Wheel.—Figs. 1 and 2 show respectively a sectional view and side elevation of an artillery wheel. The flanges B, of iron ½ in. thick, are shrunk on to the gunmetal box A, and sixteen ¼-in. bolt-holes, as C (Fig. 2), are put through each flange. In putting the flanges together, insert four bolts only, and make thirty-two blocks of oak, as D (Fig. 1), to fill up the space between the flange and spokes. When the spokes are all driven

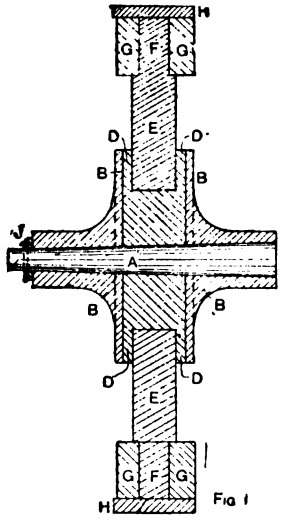


Fig. 1

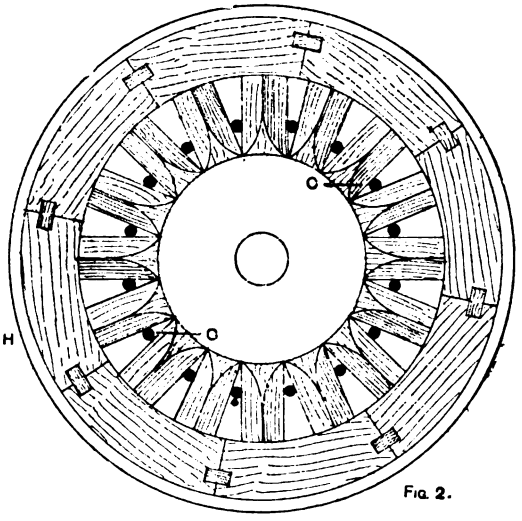


Fig. 2.

Artillery Wheel.

in, as E (Fig. 1), put in the rest of the bolts and cut square tenons 2 in. by 2 in., as F (Fig. 1); the felloes are 3½ in. deep by 5 in. wide, as G (Fig. 1), and the tyres are ¾ in. thick by 5¼ in. wide, as H (Figs. 1 and 2). The Drabbles axle is of 2¼ in. diameter, fitted with a collar and linch outside the box, as J (Fig. 1).

Preventing Sound Passing through Party Wall.—The only method of effecting this purpose is to build the party wall solid, taking care that all the joints are well filled with mortar. No joists should be fixed in the wall, and the space behind the skirtings should be filled with plaster, and not left hollow. The plaster used for the wall should be of good quality. A further precaution would be to cover the wall with three-ply Willesden paper before fixing the ordinary wall-paper.

Easy Method of Finishing Woodwork.—The process of French polishing as a means of finishing furniture and woodwork is generally regarded as a most tedious operation, owing to the number of solutions to be used on work that is built up of various kinds of wood, in bringing it up to uniform colour, and in polishing it so as to bring out and reflect to the fullest extent the markings or figure of the wood. On high-grade goods with a bright lustrous level finish this is so. Yet much furniture is not of high-grade finish, so far as the polisher is concerned; for instance, bedroom furniture that is stained green is rarely finished out extra bright, and the same may be said of fumed oak goods and many American organs. In fact, some goods look far better with a faintly lustrous polished surface than if finished out very bright, especially if the surface is at all uneven or badly cleaned up. A process of finishing known as "dry shining" strikes a medium between high-grade finish and simple spirit varnishing. In the crudest form of this process the work is simply oiled and a wet rubber of polish applied all over, not sufficient being used to fill the grain, but just enough to kill the oil. This treatment is generally considered good enough for the insides of drawers, cupboards, etc., the object being to remove an unfinished appearance and to prevent the surface getting as dirty as it otherwise might. From this better degrees of finish may be reached. The work may be oiled, filled in, one or more rubbers of polish laid on just to fill up the grain, and then an even coat of spirit varnish applied. If the articles are of white wood, they may be stained to imitate some choicer wood before oiling; and if the goods are likely to be subject to hard wear, the coating of spirit varnish may be omitted, the polish being worked out fairly dry to ensure the removal of all oil; a coat of oak or painter's varnish could be applied to give a bright surface with the minimum of trouble. Egg-shell finish also does not require the troublesome operation of spiriting out. Here the work is brought up to a stage nearly approaching that for spiriting, but the surface of polish when hard is dulled by rubbing or brushing with fine-grade pumicestone powder or flour emery, in which condition it may be left. If a gloss instead of a shine is preferred, the wood should have a smart rubbing of beeswax and turps. Black work has a specially chaste appearance thus finished, and the black stain of logwood and iron solution may be used, aniline spirit black being employed for imparting density of colour to pale shellac polish. If it is not convenient to use varnish, and a simple solution of shellac in spirit (4 oz. orange shellac dissolved in 1 pt. methylated spirit) is the only solution at hand, a passable finish may still be gained by enclosing the pad in a piece of soft rag and finishing out by working it in straight lines, after a body has been put on without a covering. When the articles must be stained, it will be found more economical to buy the stains ready made if only a small quantity is required. Dry shining has at least the merit of building up a surface that can be taken in hand again at some future time and French polished.

Spirit Level Casing.—A good way to protect a spirit level from injury when not in use is to case it in wood as is done with an oilstone. The level should fit in loosely enough to be easily taken out when required. Well-seasoned English birch is a very good wood for these cases; and pieces of suitable size which have been used in old furniture, such as four-post bedsteads, etc., can be frequently picked up cheap at jobbing joiners', wood turners', or marine stores. For ornamentation, a ¼-in. sash ovolo can be worked round the lid, which should be hinged with a back flap and fastened by a spring catch on a hook and eye. The case should be rubbed up from time to time with beeswax and turps.

Conveying Fumes from Gas Rings.—To convey fumes away from two gas rings fixed in a kitchen recess, the rings may be covered with a hood from which a pipe leads into the kitchen chimney. The hood must taper up from the full width of the opening at the bottom to a width of about 12 in. at the top, the angle being 45°. From the top of the hood a pipe not less than 6 in. in diameter must be led preferably into the chimney; if the pipe is taken to the open air through an outside wall, the apparatus will almost certainly fail.

Weed and Grass Killer.—For killing grass and weeds a strong solution of arsenic in caustic soda may be made by dissolving 6 oz. of caustic soda in 1 qt. of water, and boiling with white arsenic till it is saturated. This is a very deadly poison, and therefore requires careful handling. A harmless material is chloride of lime; this may be sprinkled over the grass and then watered.

Brass Furnace and Core-stove.—Below are hints as to a method of fitting up a core-stove in conjunction with a brass furnace that will melt about 100 lb. of brass. The waste heat from the furnace may be utilised for warming a core-stove by carrying the flue from the back of the furnace under and round the core-stove, the products of combustion eventually passing away by a flue chimney equal in height to the regular chimney. The inside of the stove should be of iron and the outside might also be of iron, but brick

Brass Furnace and Core-stove.

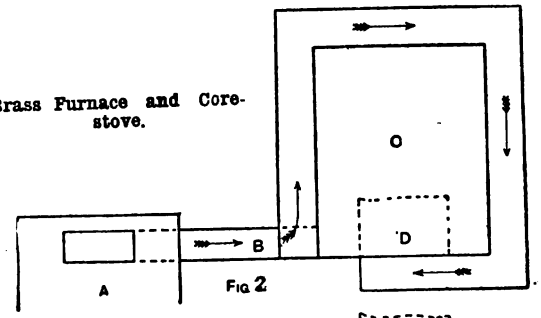


Fig 2.

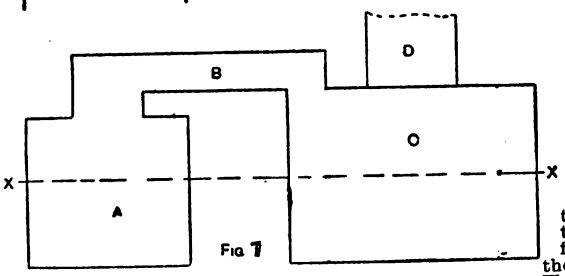


Fig 1

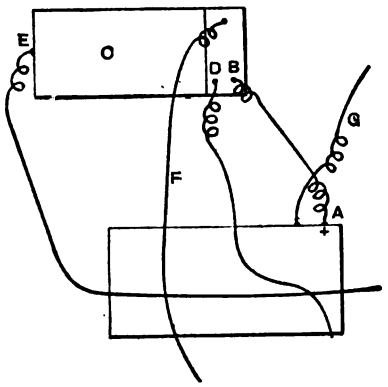
would be much better. Fig. 1 (a plan) and Fig. 2 (a sectional elevation on X X) will give a general idea of the stove that can be altered to suit particular needs. A is the furnace, B the flue, C core stove, and D exit to stack. By constructing the flue in the manner shown in the illustration the gases will pass up one side, over the top, down the other side, round the bottom, and find an exit at the back, the heat consequently circulating all round the stove (except the front). About a brick and a half will be ample allowance, and a flue cover must be provided for the periodical removal of flue dust.

Carbolic Soap.—To make carbolic soap, saponify tallow bleached palm oil, and resin with caustic soda lye, the caustic soda being in slight excess. Convenient quantities are 50 lb. of tallow, 30 lb. of palm oil, 20 lb. of resin, and 17 to 18 lb. of caustic soda made into a lye of 24° Tw., or into two lyes, one of 16° and the other 24° Tw. When the soap is made, 10 lb. of Calvert's carbolic may be stirred in and the soap moulded. For a red soap use ordinary palm oil and add a small quantity of red colour. For making medicated carbolic soap, instructions are given in Series I., p. 300.

Hard Aluminium Alloy for Castings.—The hard aluminium alloy known as 6-per-cent. consists of 94 parts aluminium and 6 parts copper. This is largely used in the manufacture of the stay pieces and the framework generally of boats, and for similar purposes. To make this alloy, a preparatory alloy of equal parts of copper and aluminium is first made and poured into strips or shallow moulds. It is exceedingly brittle, and readily pounds up into small pieces. A quantity of aluminium (say 44 lb.) is first melted, and when ready 6 lb. of the first made alloy known as hardening is added. This should be well stirred and poured into moulds. This makes a good sound casting alloy. Another alloy consisting of aluminium 97 parts, nickel 2 parts, copper ¼ part, tungsten $\frac{1}{16}$ part, and tin ¾ parts, also gives good results. The preparatory alloy in this case contains a proportion of aluminium, nickel, copper, tungsten, and tin as in the first case, and a suitable proportion is added to the 97 parts of molten aluminium in the crucible previous to casting.

Dyeing American Cloth Black.—If the oil used in dressing American cloth has penetrated the fibres, the cloth cannot be dyed, and will have to be painted in order to alter its colour. But if the fibres will take a dye, it is possible to proceed thus. Boil 5 lb. of logwood chips with 1 gal. of water, strain, and make the decoction up to 1 gal.; dissolve 8 oz. of sulphate of iron in 1 gal. of water. Brush the back of the cloth first with the logwood solution, then with the sulphate of iron. If the dye is fixed at all, the process may be repeated after adding about 1 oz. of carbonate of ammonia to the logwood solution.

Wiring Motor Cycle.—The accompanying diagram shows the electric ignition connections of a Hercules petrol motor, mounted either on a bicycle or a tricycle. One wire travels from the positive pole A (marked +) of the accumulator to the terminal B on the coil C, and, after passing through the coil, passes out through the



Wiring Motor Cycle.

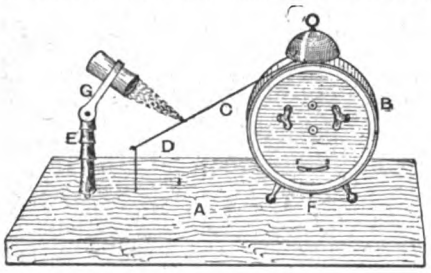
terminal D, and thence to the contact breaker through the small tube, which regulates the contact breaker, then from the contact breaker to earth, along the frame to the handle bar, and along the bar to the switch handle. The secondary current leaves the coil at the opposite end E, and runs to the sparking plug, to earth, and to the A terminal on the coil. The wire F travels from the coil to the earth or engine clip, and the wire G travels to the switch handle.

Removing French Polish and Stain from Marble.—To remove red French polish and stain from marble, wet the marble with water and, whilst still wet, pass a sharp chisel along to remove the polish. Or try the effect of soaking the stains with oxalic acid (½ oz. dissolved in ½ pt. of water), then neutralise any acid that may be left by wiping over with common vinegar. If this does not suffice, use Castile soap and water with a little ox gall. If the stains are obstinate, make the mixture into a paste by thickening it with fuller's-earth, spread over like paint, allowing the paste to remain a couple of days before washing off.

Varnish for Golf Clubs.—Spirit varnish is suitable for golf clubs, as it dries very quickly and colour may be added to impart a darker shade if desired. For a brown colour, add dry brown umber or vandyke brown; for a red, a few grains of Bismarck brown per pint will suffice, or a rich brown can be gained by a careful admixture of brown and red. The following will give a quick-drying bright varnish. Methylated spirit, 1 pt.; shellac, 4 oz.; benzoin, 2 oz.; and venice turpentine, 1 oz. Add colour to suit requirements. Carefully strain through muslin. Apply with a camel-hair brush, and set aside in a warm room to dry.

Angus Smith's Solution for Coating Pipes.—Iron pipes properly coated with Dr. Angus Smith's solution are not affected by either soft or hard water; but some difficulty may be experienced in properly coating small-sized iron pipes. The Angus Smith process is as follows. The original recipe consisted of 30 gal. of coal-tar, 30 lb. fresh slaked lime, 6 lb. of tallow, 3 lb. lampblack, and 1½ lb. of resin, well mixed, boiled for twenty minutes, and applied while the mixture is hot. The solution now generally used is composed of three and a half barrels of coal-tar, half a barrel of coal-oil, and half a barrel of pitch; 6 tons of gas-coke will be required for heating the pipes. The immersing tank should be made of wrought-iron, and be long enough to take a 9 ft. length of pipe. Put in sufficient coal-tar to half cover a pipe; pitch, beaten to a powder, is then sprinkled on the tar, and coal-oil is poured on the pitch. The pipes, heated from 180° to 200° F., or as hot as the hand can bear, are placed separately in the liquid, and turned over and over for two or three minutes, then reclined at an angle to drain, the lower end being kept clear of the liquid. The quantities named in the above recipe will be sufficient for about a thousand pieces, bends, branches, and straight pipes, or say three-quarters of a barrel of coal-tar to a hundred 9-ft. lengths of 4-in. pipe.

Clock Regulating by the Sun.—In many country districts watchmakers would find the following plan for correct timing by means of the sun very useful day by day. Take a block of wood A 14 in. by 6 in. and 2 in. thick, and arrange on it a timepiece B, thread C, wire D, and stand E for a burning glass. Any old disused alarum timepiece will do, as the alarum part only is required. To the small hammer part fix a wire hook, set the hand on the dial so that the alarum runs, and

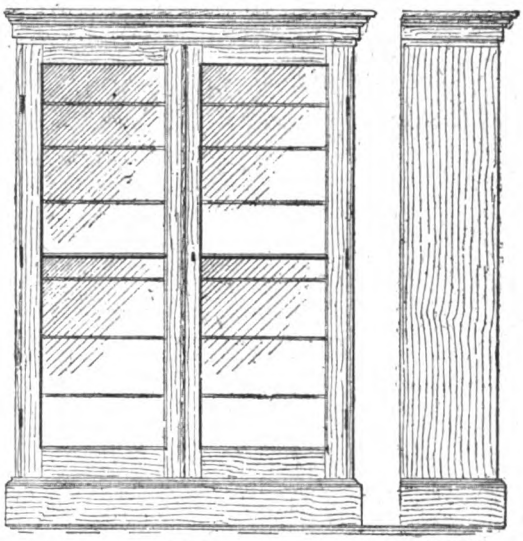


Clock Regulating by the Sun.

leave it so. The going part is of no use; the alarum is simply wound a few turns only each day after the thread is in position. Make two small holes for the clock feet to rest in, and put a slender screw through the bottom at F into the wood block. The clock bell part, etc., is then ready. Next fit up the glass for the sun's rays. Take a lens of short focus and fix it within the lower end of the tube; this only costs a few pence. Make the metal band to hold it in position, and rivet this to the upright G, which can be of iron or brass filed flat at the top with a hole drilled across for the rivet of the band; this should allow it to be raised or lowered according to the period of the year when the sun is high or low. The thread is wrapped round the wire a few times. To find the position in which to fix the apparatus permanently, place it on the bench or on a bracket in the window side, facing south. Set it with a compass so that the alarum part is north and the lens, etc., south. To find the true 12 o'clock meridian line, make a mark where the sun shines on the pillar at the top, causing a shadow line at, say, 10 o'clock; then do the same at 2 o'clock, and with a pair of fine compasses place one point at the foot of the pillar and the other on the mark for 10 o'clock; turn it so as to reach the 2 o'clock mark, thus forming a part circle between the two, and midway between is 12 o'clock. Draw a line there, and the lens must show the sun's rays on this line, the thread of course just crossing above with the sharpest focus point shining on it. When the precise moment arrives, it burns the thread and the bell rings for a short or long time according to the number of turns previously given to it.

Mounting Pictures to Resemble Oil Paintings.—For mounting pictures to resemble oil paintings, a wooden frame is necessary. To make this four strips of batten 1¼ in. by ⅝ in. should be cut to the required lengths and planed and bevelled two-thirds of the width of the stuff, so that the outer edge of the stretcher is somewhat higher than the inside, and mitred in the usual way. The frame is now covered with calico drawn tightly over the surface and tacked round the edges. To mount and finish the picture to resemble an oil painting, cut away all the margin, place the print face downwards on a perfectly flat surface, and coat with strong paste. Lay the canvas down on the picture and rub firmly on the back and edges, thus bringing the pasted surface into contact. When dry, size the surface of the print thoroughly and varnish either with copal or mastic varnish. Small prints may be mounted on pasteboard instead of being placed on stretchers; this plan, however, is not generally satisfactory, as it is difficult to remove a picture so treated from the pasteboard should occasion arise, whereas it is very easy to strip a print off canvas without the least injury.

Lock-up Bookcase.—Figs. 1 and 2 are elevations of a lock-up bookcase. The sides, top moulding, plinth, and door frames are of walnut, and the back, floor, roof, and shelves are of white wood, the shelves being faced with a walnut veneer 1 in. deep. The back is made for strength in the form of a nine-panel frame, and the shelves are held by walnut crossbars 1 in. wide; they rest on notched bars in the usual manner, the bars being cut at every 2 in. The shelves are 12½ in. deep, so that, if necessary, a double row of books of ordinary size can be accommodated, and even the largest sketch books,



Lock-up Bookcase.

at 2 in. from the bottom of the carcase, and resting on the first steps, the bottom shelf leaves a long open space, exceedingly useful for drawings, art magazines, and large papers, especially as the opening is below the level of the glass and therefore hidden. The height inside the carcase is 65 in., the plinth measures 6 in., the top moulding 3½ in., and the width from outside to outside is 43 in. The glass for the doors is in four panes, the width of the frames being 2¼ in., except along the bottom, where it is 4 in. A light moulding divides the panes, and edges the frames and outer door. The top moulding is built on a frame, screwed down to the roof of the carcase. A bolt at the top and another at the bottom secure the inner door.

Action of Lime on Wood.—Pitchpine not protected (that is to say, the bare wood being in contact with the lime), will undoubtedly suffer more than seedpine. Lime, in the case of most pine woods, has the effect of converting and rendering volatile many of the essential elements of the pine, mostly those elements of a resinous character. Pitchpine, if not painted or coated with varnish on its surfaces, gives up these essential elements to an ordinary atmosphere more quickly than the majority of woods, becoming thereby a more brittle, exhausted, and altogether less trustworthy material than any other wood. This condition is not, of course, attained for many years. In contact with lime this disintegrating process will advance more quickly. If, however, the wood is thoroughly dried, and afterwards well painted or varnished, on all sides and ends, the volatilisation will be largely prevented, and the life of the wood will be in accordance with the protection afforded it.

Grey-mottled Soap.—A genuine grey-mottled soap should be made in the ordinary way, the ingredients being tallow 60 lb., palm kernel oil 5 lb., with the requisite quantities of caustic soda lyes; the lyes used are, first, of 16° Tw., and, second, of 24° Tw., about 9 lb. of solid caustic soda being required. The soap is separated by common salt from the glycerine and impurities, reboiled to a homogeneous paste, and then run into the moulding frames. A canvas bag containing the colouring matter is then pulled through the frame, thus leaving streaks through the soap. The colour may be made by intimately mixing 3 lb. of ultramarine blue and 4 lb. of lampblack.

Replacing Wooden Door Panels with Glass.—Below is described the manner of replacing with glass the two top wooden panels of an ordinary door. Remove any mouldings that may be round the panels, as shown in Fig. 1; then bore a hole in the top left-hand corner of the panel, insert a saw, and cut all the way round close to the edges of the stiles and rails without injuring them. Then take out the portions of the panels remaining in the plough grooves, and fill up these grooves with strips, as shown at A in Fig. 2. These strips may be glued in if desired, or may be secured with sprigs, and must, of course, finish quite flush with the edges of the stiles and rails. Then mitre round the opening with ¾-in. beading (which, if too wide, must be planed to breadth), fasten with sprigs, insert the glass, and secure the beads on the other side. The beading that is put on last is preferably fastened with screws, so that in case of breakage the glass is easily replaced.

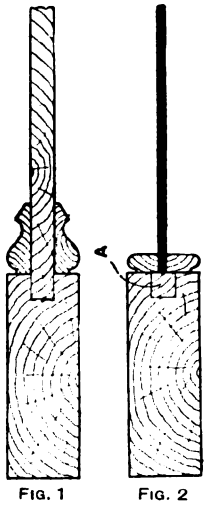


FIG. 1 FIG. 2

Replacing Wooden Door Panels with Glass.

Floorcloth Manufacture.—The foundation of floorcloth is a coarse jute or hemp cloth filled and stiffened with gelatinous substances, such as glue size, potato starch, etc., and subjected to powerful calendering to get a smooth even surface. It has then much of the appearance of brown buckram, but of a more elastic feel. The body colour is then laid on, which consists of heavy mineral ochres, paint manufacturers' tailings, and lead oxides, ground up with linseed oil and driers. The body colour is run from the mixing pans into a trough, which can be adjusted to a more or less inclined position, and the overflow falls on to the cloth which is passing underneath; it then travels to a set of spreaders, then through a pair of soft felt-covered calender bowls, and successively to papier-mâché, boxwood, and steel rollers. The cloth is then taken to the drying loft for the surface to harden, and is then given one or more coats of paint on both sides and again allowed to dry. The next process is the printing; this was formerly done by hand, which, however, has been superseded by a machine capable of printing twelve separate colours in one operation. The floorcloth passes over a large wrought-iron drum, which has around its periphery twelve engraved rollers, each having its own separate colour box and wipers, and capable of fine adjustment, the decorating being complete as the cloth leaves the machine. After drying, the surface is varnished and taken to a heated room to prevent blooming, and then the edges are sheared square by a machine and the floorcloth is seasoned, this taking from one to three years, and being an important bearing on the wearing qualities of the floorcloth. Borders and narrow widths are made several at a time and afterwards slit up.

Bits for Boring Holes in Wood.—For dead true work, in all directions of the grain, bits of the kind shown in Fig. 1 are used. These are best known in connection with metal work, and the metal-working bits operate in wood quite easily, but the same pattern bits are now made specially for work in wood, and may be had from the smallest sizes up to 2½ in. in diameter. A quick-feed bit as shown at Fig. 2 is better adapted for boring short depths in the end grain than for side-grain work, its work in the latter case being very coarse. The centre-bit shown at Fig. 3 is a very clean-working tool, and when fixed on the end of a saw spindle or lathe mandrel the work may be fed up to it at any speed. It should be noted that the work of boring with a centre-bit of larger diameter than 1½ in. is made much easier if the bit has a second vertical cutter. The boring tool shown in Fig. 4 is intended for side-grain work only. It is adjustable in regard to size, and, within the limits of the cutter, will bore circular holes of any diameter. It will also do trenching, grooving, and surface sinking to any pattern where a suitable mould is provided. This tool is chiefly used in connection with the "elephant" machine, but is equally well adapted for use on the lathe. There is an element of danger, however, in its use, as it is not provided with a centre point, and therefore, when running at a high speed, is liable to do considerable damage, unless the work is fed in a regular manner and held down with absolute security. In the drawing a universal chuck is shown attached to the head of the bit. Fig. 5 shows an American reamer, a tool specially made for ladder makers and wheelwrights. It is stocked in all sizes from ¾ in. to 6 in. at the large end, and may be had either with long or short tapers. The larger sizes are for reaming out the hub blocks of wheels, ready for inserting boxes. The same bit is made in all sizes up to 6 in., but with parallel sides, for straight boring. Fig. 6 shows a twist bit of special value to wheelwrights, having shoulders at the large end adapted for cutting recesses to suit various styles of boxes.

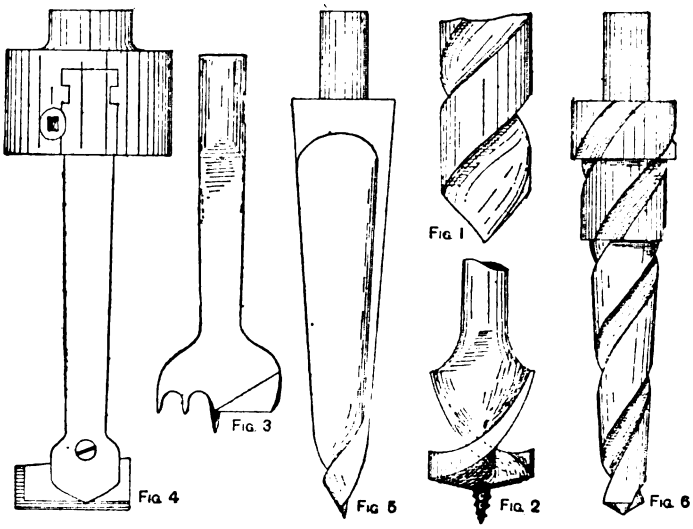


FIG. 4 FIG. 3 FIG. 5 FIG. 1 FIG. 2 FIG. 6

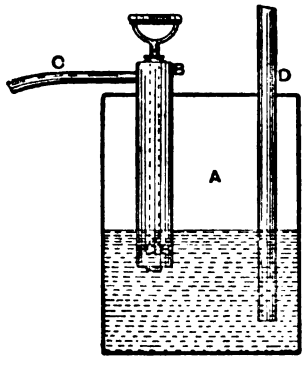
Bits for Boring Holes in Wood.

Filling Cracks in Artificial Leg.—A good filling for cracks and uneven places in an artificial leg is white-lead putty; this is ordinary putty mixed with sufficient white-lead to make it soft. Scrape the crack clean, rub some white-lead well into the crevices, then fill in with putty and allow it full time to get hard before covering the spot with leather. The leather used in covering artificial limbs is very thin and light, similar to that used by bookbinders, but dyed pink or brown instead of purple or black.

Removing Colour from Meerschaum Pipe.—A meerschaum pipe which has coloured unequally through lying on one side may have the greater part of the colour removed by steeping it for some time in moderately strong ammonia solution, 1 part of strong ammonia to 2 parts of water.

Ventilation of Bedroom.—A chimney in good working order is the best extractor of vitiated air that could be wished for; ascertain, therefore, whether the chimney of the bedroom fireplace has in it an active and constant up-draught. Ascertain next whether plenty of air can enter the room. Air usually enters a room through the fissures around and under the door and the windows; and unless draught stopping has been used, the air that enters a room in this way is considered ample for a bedroom occupied by two persons. The air that enters the room should be pure and wholesome; in ordinary residences most of the air enters the room by the opening under the door, and usually this air is considered sufficiently good for ventilation purposes. Perhaps the safest remedy is (provided the chimney has in it a proper draught) to fix a 9-in. by 3-in. Tobin's tube ventilator in the outer wall of the bedroom. The best air, and as much as is required, will then be obtained. The entry of air into a room is wholly dependent on the extracting qualities of the chimney; new air, therefore, cannot enter a room if none of the air already in the room passes out.

Oil-gas Burner Lamp.—In order to burn petroleum or kerosene under pressure, the burner should be above the oil container; consequently, pressure is needed to raise the oil to the burner. The sketch shown below roughly illustrates the principle. A is an airtight metal drum, B is a pump, and C the suction pipe; D is a tube fitted with air- and oil-valves, on the top of which the burner is fixed. Oil is pumped into the drum with B, thus causing the air already in the drum to be compressed; the valves are then regulated, and the oil is forced up to the burner, vaporised, and burnt. A pressure gauge should be attached, and the apparatus should be worked at about 18-lb. pressure. Great illuminating power can be obtained from lamps constructed on this principle, but the light depends on the size of the burner, which is made of cast-iron.



Oil-gas Burner Lamp.

Care of Billiard Balls and Tables.—When billiard balls jump the pocket the cause often is to be found in some slight unevenness in the covering of the table bed leading to the pocket, or the table may be out of level. Of course, the trouble may be due to the player or the ball may be foul. To test a ball, place it in baulk and strike it with sufficient force to cause it to run twice up and twice down the table; if the ball whilst running makes a sort of rattling noise it is a foul ball, and instead of being a perfect sphere inclines slightly to the shape of an egg. After the balls have been in use for some time and have been subjected to a great deal of knocking about, the ivory not only becomes seasoned but also expands unequally, so that the balls are no longer perfect spheres. They can then be sent to the makers to be re-turned. An excellent plan to preserve billiard balls is to bury them, when play is finished, in sawdust saturated with sweet oil. Apparently the oil is taken up by the ivory and compensates for the effect of the heat of the day. Heat is a great destroyer of the accuracy of billiard balls, consequently in India and in other hot climates it is a very rare occurrence to find a set of billiard balls that are true. To test the accuracy of the cushions, they should be looked at from a point in the prolongation of the cushion, and if the edge is not a perfectly straight line they are not true; either the rubber has come away from the foundation, or the cloth has been pulled tighter in some places than others. To test whether a table is horizontal, use a long spirit level, which should be placed on the bed of the table in various directions and reversed; if the air bubble in the level remains in the centre under all conditions, the bed may be considered true. The cloth covering of the bed requires special and constant attention, and should be kept carefully clean by brushing followed by ironing.

Roman Chariot.—Fig. 1 is a side elevation of a Roman chariot for use in a carnival; Fig. 2 is a plan of the bottom framing drawn to a scale of ½ in. to the foot. For the bottom frame thoroughly dry English ash should be used; the two bottom sides A (Fig. 2) are 4 ft. long by 3½ in. wide by 2½ in. deep; the two cross bars B are 2 ft. 3 in. long by 4½ in. wide by 2½ in.; the centre bar C is 4 in. wide by 2½ in. deep, and framed as shown.

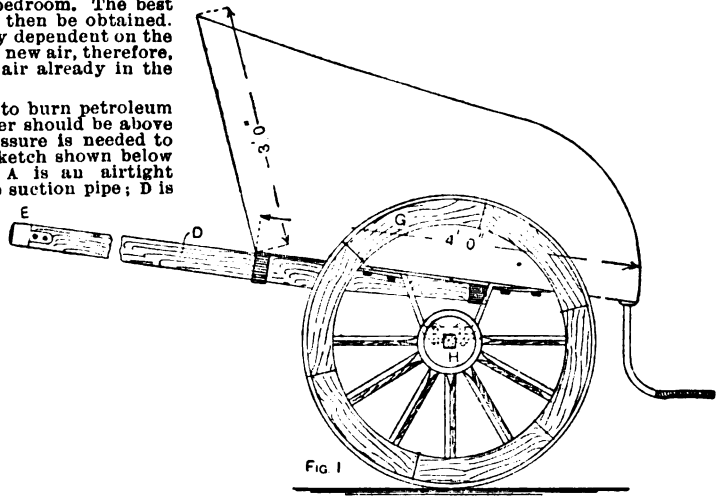


Fig. 1

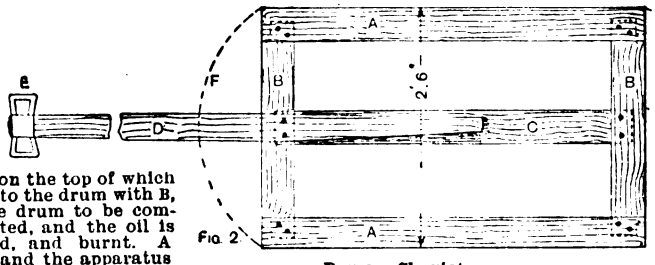


Fig. 2

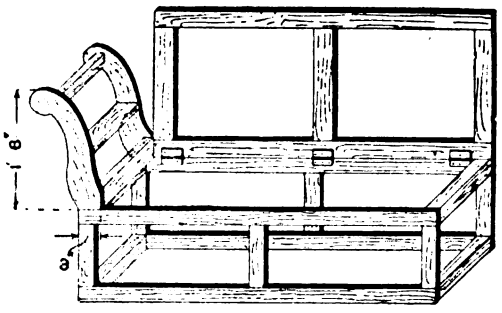
Roman Chariot.

The pole D (Figs. 1 and 2) is 9 ft. long by 3½ in. square, tapering towards the front to 2½ in., and a pole crab is fitted as shown at E. The sweep at the front of the body is indicated by the dotted line F (Fig. 2). The bottom boards are 1-in. elm, the grain running across the body. The wheels G (Fig. 1) are 3 ft. high, the felloes 3 in. square, the diameter of stock is 8 in., and the length of the stock 9 in. The spokes, twelve in number, are 2½ in. The axle H (Fig. 1) is 1½ in. square, and is fixed to the iron stay. The distance between the flap and collar is 2 in., and a common grease axle is used, having right- and left-hand threads and a linch pin. The body should be painted yellow, picked out in blue, and the wheels red, picked out in black. The sides and front may be of canvas, and battens will have to be put in the body to keep it in shape. The pole will have to be fitted with two whiffle-tree bars, and the harness will consist of bridle, breast strap and pad, crupper strap, and reins.

Bending Walking-stick Handles.—The handles of hazel sticks may be bent either at first, when the sticks are fresh cut and when heat only is necessary to effect the bending, or after they have been stored and dried. In the latter case the part to be bent must be placed in boiling water until it becomes pliable, or else (where there is a danger of staining the wood) it must be subjected for a long time to the direct action of steam. There is less danger of the bark peeling away at the bend when the sticks have been stored for a year than when the sticks are bent fresh. Before the binding or frame is taken off the sticks should be dried in an oven.

Scratch Knots.—Scratch knots in any size may be made with a machine for whipping large cables with copper wire. The principles of construction are similar to those of a gimp-making machine. The strands of brass wire pass from bobbins of the required number through a pipe, and are whipped with copper wire as they emerge from the pipe; then the whipped cable is wound on a drum. To form the scratch knots, this cable must be marked off in divisions of the required length, and a speck of soft solder must be secured to the whipping wire 1 in. each side of each division, to prevent unravelling when the cable is cut. The division marks must next be cut through with a fine circular saw, and the loose ends of the whipping wire cut off, or secured by solder as required.

Ottoman Couch.—The illustration shows the complete framework of an Ottoman box-couch. The principal measurements are, total width, 2 ft.; length, 5 ft.; height of box portion, 1 ft. 3 in.; height of arm, 1 ft. 8 in.; seat lid, 4 ft. 9 in. long by 2 ft. wide. The carcase is made of 1½-in. by 2½-in. stuff, with mortised joints, the bottom being covered with matched boarding. The scroll arms are made of 1½-in. stuff, 3 in. wide at the bottom, with a rake of 5 in.; these arms are framed up to 2 ft. wide over all by housed cross rails and foot rails, and secured to the carcase by dowels at each side. The seat lid side rails are made of 1½-in. by 1¼-in. stuff, and the cross pieces should be 3 in. wide, mortise-jointed, and hung on three wrought-iron butts. Plate castors should be fixed at each corner. The whole of the open spaces should be cross-webbed and covered with hessian. The stuffing (which can be a light mill-puff) should be strung

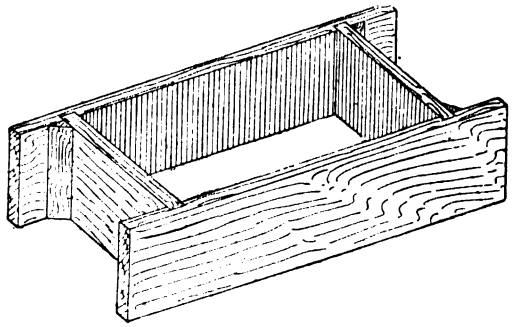


Ottoman Couch.

on the sides, ends, and arm to a fulness of about 1½ in. The seat will require stitching up to a firm square edge, as also the edges of the scrolls. Printed pique, cretonne, or cotton tapestries will be a suitable covering, the borders being set off with a coloured cord. Line the inside with sateen or Roman satin.

Æolian Harps.—Æolian harps usually are made the length of the window at which they are to be used, as the object should be to prevent air passing in without going over the strings. A twelve-stringed harp which is of convenient size, as it will do for several windows, is 32 in. long, 5 in. broad, and 3 in. deep (outside measurements). If this is not long enough for any particular window, cut a piece of board about 3 in. longer than the vacant space and the width of the side of the harp, and fix the board by a screw to the side of the harp, so that when not in use it will turn back and lie snug along the side. For the bottom of the harp use ⅜-in. yellow pine, ¼-in. pine for the sides and belly, and beech for the blocks and bridges. Begin by getting out the bottom, 4¼ in. wide, on the outside edges of which glue and brad on the sides. Fill up the right-hand end with a wrest-pin block 4 in. long, and the other end with a hitch-pin block 3 in. long, observing that the grain of the blocks runs the same way as the box. These blocks must be very accurately fitted, after which glue and cramp them in place, then dress the tops flush with the sides. In the centre of the belly is cut a sound hole 2½ in. in diameter (if the harp is made longer than 32 in., two holes may be cut at a distance of 9 in. from the ends), and, after careful fitting, it can be glued and cramped on top of the box. A wind board, to ensure that all wind passes close to the strings, should be made of ⅜-in. stuff of the same sizes as the harp, and having end pieces 1½ in. by ⅜ in. glued on so that the board stands 1½ in. above the strings, a dowel in each end keeping it in position, and at the same time making it easily removable for tuning, etc. The two bridges are made of beech ½ in. high, ⅝ in. wide at the base, and tapering to ¼ in. at the top, the length, of course, being the width of the harp. The holes for the wrest-pins can now be bored at 1½ in. from the right-hand end (that having the longest block). Draw a line across the harp, and on this line bore holes to fit the pins at a distance of about ¾ in. from each other, the first hole to be about ¾ in. from the front edge. One inch in advance of this line bore another set of holes, coming exactly between those of the first row. Note that these holes should be bored at an angle of about 20°. At the other end mark off corresponding positions for the hitch-pins, after which clean up, stain, and varnish, or finish to fancy. When dry, the wrest-pins can be inserted and hitch-pins driven in, leaving ¼ in. outside. The harp is now ready for stringing up, the strings used being first-violin E gut strings; care must be taken that they gauge exactly the same size. When all the strings are on, place under them the bridges at 2 in. from the pegs at each end, and proceed to tune. The best results are obtained from a low pitch, and the strings should all be tuned to a perfect unison. As a rough guide for the pitch, try C in bass clef, but it will be as well to experiment with several notes, observing which gives the best results. When it is desired to use the instrument, place the wind board over the strings, stand the harp on the window ledge, and pull the sash down close to the top of the wind board, so that air cannot enter the room without passing over the strings; sometimes the door has to be opened to get sufficient draught.

Mould for Brickmaking.—The moulds for making bricks by hand may be constructed out of ⅞-in. deal and lined with sheet zinc. The ends are housed into the sides and nailed, and blocks at the corners, as shown,



Mould for Brickmaking.

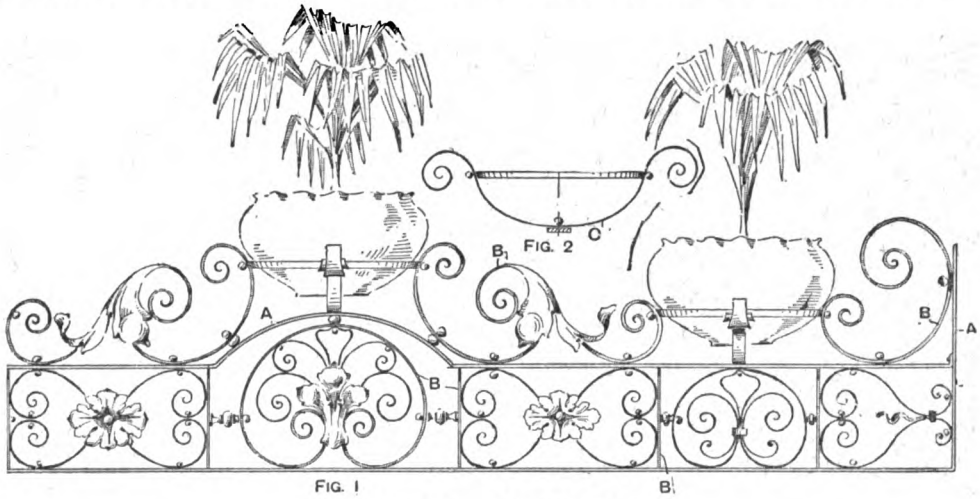
will add to the life of the mould, which is open at the top and bottom. The inside dimensions vary slightly, but the orthodox brick is 9 in. long by 4½ in. wide and 3 in. thick. The allowance for shrinkage of the clay in drying and burning is usually from 10 to 15 per cent., so that the mould will require to be made correspondingly larger. In use, a lump of the tempered and plastic clay is cut off by a lad, rolled in dry sand, and handed to the moulder, who has previously sprinkled the inside of the mould with a handful of dry sand to prevent the clay sticking. The clay is then pressed in, the surplus struck off with a flat wooden paddle, known as a "strike" or "strickle," and the brick turned out on to a flat board called a "pallet," a little larger than the brick. On this the brick is taken away to the hacks to be air-dried.

Removing Broken Dowel Screws from Umbrella Handles.—The best plan whenever possible of removing broken dowel pins from umbrella handles, sticks, etc., is to cut off a small portion of the handle so as to expose the broken end of the screw, which can then be fixed in a vice and twisted out. Failing this, the screw can be drilled out with an ordinary Morse drill in the lathe. A special drill for drilling out broken screws is formed of steel tube, and lets the broken screw pass up the centre.

Removing Brazing Marks from Silver.—Solder will run away from a part of a joint instead of running into it when the edges of the joint have been imperfectly cleaned preparatory to the application of flux and solder; also, if some dirt has got into the flux, or on the pallions of solder employed. Another cause is unequal heating of the joint, or allowing it to expand too much whilst being heated. The resulting fire marks may be removed by warming the articles on a pan over gas, and plunging the n whilst warm in a pickle composed of sulphuric acid 1 part, water 10 parts. Or the marks may be removed in a hot and strong solution of potassium cyanide, and the polish renewed by a light polishing with a revolving swansdown mop and rouge composition.

Copper Sulphate.—Large quantities of copper sulphate are prepared by roasting copper pyrites (a double sulphide of copper and iron), whereby oxides of copper and iron are produced and sulphurous acid is given off. The latter is converted into sulphuric acid in the leaden chambers. The roasted mass is heated in leaden pans with sulphuric acid and steam, and the sulphate of copper is obtained by crystallising out. If a pure sulphate is required, the first crystals are dissolved in a little hot water, the solution evaporated, and then allowed to cool, when the pure salt separates out. Copper sulphate is also produced directly by carefully roasting copper pyrites. The roasted material is treated with water and the sulphate of copper obtained by evaporation as above described. After separation of the greater part of the sulphate of copper by crystallisation, there is still a portion left in the impure liquor. To recover the copper from this liquor, iron plates are placed in it, and these precipitate the remaining copper in the form of a fine powder, which, after washing, is also dissolved in sulphuric acid.

Window Flower Stand in Iron.—Window fern or flower pots help to give an air of freshness to a house and to relieve the monotony of bricks and mortar, and the effect is enhanced when the flower pots are supported in an ornamental wrought-iron stand. The design must, of course, depend largely on the size of the window sill; that shown at Fig. 1, however, may be adapted to any ordinary dimensions, but before starting work a full-size drawing will be necessary. The sections of metal are as follows. The frame A is 1 in. by $\frac{5}{16}$ in., the scrolls and uprights B are $\frac{3}{4}$ in. by $\frac{3}{16}$ in., and all the rest of the work may be $\frac{1}{2}$ in. by $\frac{1}{2}$ in. The leafwork will, of course, be beaten out of charcoal iron and screwed or bolted on with round-headed screws. The carrier rings for the pots are given extra support by the scrolls running back and front, a side view of such a scroll being given at C (Fig. 2).



Window Flower Stand in Iron.

Replacing Split Top Bridge of Piano.—Replacing the split top wooden bridge of a piano with a metal one would impart to the instrument a metallic tone quite different from the previous tone. Experiments have been made of inserting a small section of metal or stone bridge at the extreme treble end with the object of improving the tone at this point; but the idea is now discarded in favour of a brass pressure bar, which may be used whether the bridge is pinned or not. If the defective bridge is a pinned one, it should be replaced with one of similar construction, and in order that this can be accomplished, the steel wires must be removed from as much of the bridge as will be required to be cut away, and it will generally be found less trouble to restring with new wires than to attempt to use the old ones again. Before removing the wires, note whether the wire gauge marks are indicated on the plank, such as Nos. 13, 14, 15, and so on; these numbers give the size of the wires to the right of them, but if they do not exist, make a memorandum of the number of notes that go to each gauge of wire, and for this purpose procure a music wire gauge. Then draw out the pins, and with a fine saw cut through the bridge where required, keeping the cut in line with the wires. Take a rubbing of the bridge on stout paper with heel ball, but be sure that it is a clear imprint showing the flat face, bevels, and pin holes. Next with a sharp chisel lift up the portion to be removed, and cut off a portion, or send the whole piece with the paper imprint to ensure having the new piece of the same thickness. Fit the new piece into position, and bore and countersink holes for flat-head brass 1-in. screws. Bore holes between the string spaces not to interfere with the bridge pins, and then make secure with hot glue, the bearing surface being perfectly free from varnish, old glue, or remnants of the old bridge. Next day tap the bridge pins home till they project $\frac{1}{4}$ in. full, then with a flat file level down on a line with the others, put on new wires, and pull up the tension gradually till they sound fairly well in tune.

Painting Tarred Surfaces.—The difficult task of obliterating tarred surfaces with ordinary paint is never accomplished successfully. The work, after being painted, dries out with the characteristic brown stain due to the penetrative action of the constituents of the coal tar, phenol, light oils, etc. Shellac knotting, of which two or more coats are applied, is used by the uninitiated as a cure, but this only acts as a temporary remedy, and in all cases, after a few months' exposure, the tar shows through the work in irregular brown patches. Many more or less unsuccessful remedies have been tried. The following method, however, has been tested by the writer on many occasions, and has been found to give a permanent cure. The preparation here described is to be used as a medium with ordinary paint. Place in an iron vessel over the fire 3 lb. of common resin. After it has melted, remove it into the open air well away from any naked light or fire, and allow it to almost set—that is, to remain just in a liquid state; then stir into it 2 pt. of solvent or coal-tar naphtha and $\frac{1}{2}$ pt. of boiled oil. Stir well together, when the mixture will gradually assume the appearance of oak varnish, and is then ready for use. Mix 1 pt. of the medium with 7 lb. of ordinary paste paint of the required colour but on no account use white-lead, which would turn into a thick unworkable mass. Use zinc white. This preparation may also be used as a preservative for damp walls, for both interior and exterior use, and for this purpose should be applied warm in order to penetrate into the pores of the brick or stonework. It dries hard in about two hours, with a glossy surface, which may be immediately papered or painted; that is, when the medium is used alone, without the addition of paint. There is no difficulty in making this preparation, and it may be prepared at a cost of 2s. per gallon, 1 gal. covering 60 sq. yd. of wood or brickwork.

Soundproofing Bedroom Floor.—To make a bedroom floor soundproof, remove the floorboards, and nail 1-in. by 1-in. fillets along both sides of the joists as close to the ceiling laths as possible without injuring the ceiling. Then get some $\frac{3}{4}$-in. rough boarding and cut in between the joists, each end lying on the fillets already fixed; the entire length must be covered with boarding. Then fill the space between the boarding and the under side of the floor with fine deal sawdust.

Destroying Moth in Plush-upholstered Furniture.—Moth and larvæ in furniture come from the stuffing material, which becomes infected because it is unseasoned green fibre or through not being properly purified. Anything applied in a liquid form will destroy to a certain extent the nap or pile surface of the plush, and on the other hand a powdered insecticide will only destroy those moths which appear on the surface, leaving the eggs, etc., to cause further mischief. An effectual remedy in liquid form is made by dissolving 2 oz. of albo-carbon in 1 pt. of benzoline. Take the furniture out of the way of fires and naked lights, and sponge freely; the pile can be raised by holding a hot flat iron close to it, and brushing up with a soft brush. Repeated sprinklings with powdered camphor or dry herb wormwood is also good. In the trade the goods would be put in a fumigating chamber and subjected to sulphur fumes.

Sharpening Hand Ripsaw.—The following method of sharpening hand ripsaws, though not generally adopted, answers well in actual practice. The teeth are filed alternately from opposite sides, as in the usual method, except that both edges of each tooth are bevelled from the same face, to form a long point at A (Fig. 1). In this way each successive tooth resembles a diamond-pointed wood chisel having a left and right cutting edge, but alternately from opposite sides of the saw blade. The set is that which is commonly given, the flat side of the pointed tooth being turned outwards alternately, as is usual (see Fig. 2). If the teeth be made slightly longer than would form an equilateral triangle, and also the side slope a little longer than is generally given, so as to

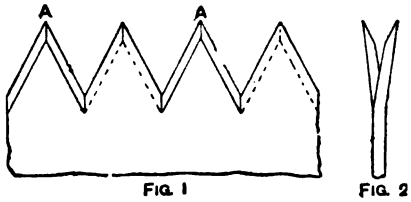


FIG. 1 FIG. 2

Sharpening Hand Ripsaw.

obtain a keener cutting edge, the saw will be found to cut much more sweetly.

Muriatic Acid.—Muriatic acid is simply a solution of hydrochloric acid, another name for it being spirit of salt, this having been suggested by the fact that the acid was formed by treating common salt. The acid occurs very little naturally, but, as a gas, is sometimes given out by volcanoes. As sold it usually has a specific gravity of 1·17, when it contains about one-third of its weight of gas, the remainder being water, of course. More exact figures, founded on some given by Ure, are as follows. A specific gravity of 1·17 corresponds to a percentage of hydrochloric acid gas of about 34, while for the proportion of 33 per cent. the specific gravity of the solution is 1·164, the temperature being 15° C. A saturated solution of hydrochloric acid in water has a specific gravity of about 1·21, the percentage of gas present being rather more than 42. The liquid fumes very freely in air, and as sold in the shops is usually of a slightly yellow colour, this being owing to the presence of free chlorine, ferric chloride, or, very often, iron. A simple method of preparing a solution of hydrochloric acid is as follows. A flask is supplied with a mixture of fused salt and oil of vitriol (sulphuric acid), and the open end of the flask is corked and fitted with a bent tube which joins it with two Woulfe's bottles connected one after another, another bent tube leading finally to a third bottle, which, like the two Woulfe's bottles, contains water in which the gas is condensed. A form of the special bottle required could be made by fitting a wide-mouthed jar with a cork in which three holes had been formed, these holes carrying plain glass tubes. Of these, the centre one dips into the water in the jar and the two others are bent outside the jar for making the necessary connections, but do not enter the water. In the second jar it is only the tube farthest from the flask that does not enter the water, and it is, of course, this one that joins up to the third jar. All the connections may be made with vulcanised tubing. The first bottle should contain the least water, which is used to absorb any salt particles that may be carried over with the acid from the flask. The object of using the middle tube dipping into the water is to admit air to the jar if the gas is taken up by the water quicker than it is supplied after heating the flask, in which case a partial vacuum would be formed; otherwise the water in the third bottle might be driven up the tube and towards the flask by atmospheric pressure. Hydrochloric acid itself, although quite easily obtainable from sulphuric acid acting on ordinary salt, cannot be collected over water, in which it is obviously very soluble; instead, mercury must be used over which the gas is readily collected. Owing to the impurities in the oil of vitriol from which the muriatic acid is obtained, it very often contains, in addition to the foreign matters mentioned above, a number of others, such as arsenious and sulphurous acid, beside sulphuric acid itself. Further, arsenic and organic matters can also be found in it. These impurities are to be expected in the acid obtained as a by-product in the manufacture of sodium carbonate (soda ash) by the salt cake process. The material being an acid, it follows that it contains hydrogen, and that this hydrogen can be replaced by a metal; this is perhaps an essential property to be looked for when deciding whether or not any particular material is an acid. It is not surprising therefore that muriatic acid will dissolve such metals as tin, zinc, nickel, and iron with which it forms chlorides, the hydrogen escaping, and it is obvious, therefore, that it must not be used continuously on engines, boilers, or similar machinery. It will be found, however, that hydrochloric acid will not dissolve pieces of platinum; this action will occur when nitric acid is added and the mixture, known as aqua regia, is warmed.

Boxes for Sending Eggs by Rail.—Below are instructions on constructing the inside wire fitting for a box for transmitting about four or six dozen eggs by rail. The wire interior is made of No. 18 B.W.G. steel wire (shaped as Fig. 1 which shows both front and side elevations) this is soldered to a piece of stout tin XXX charcoal plate A (Fig. 2) about 6in. by 8in. This

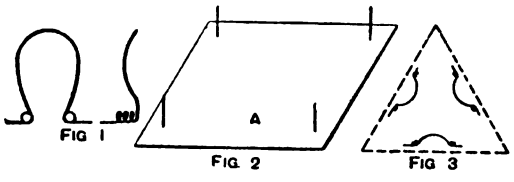


FIG 1 FIG. 2 FIG 3

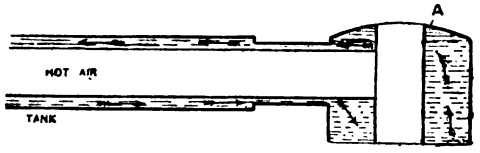
Fittings of Boxes for Sending Eggs by Rail.

will hold twelve eggs. As many of these metal stands as required can be put into a wooden case; therefore, to despatch six dozen eggs, six metal stands placed one stand over another would be required. Three-inch pieces of No. 8 B.W.G. wire are fixed in the corners of the metal stand, as shown in Fig. 2, to support the stand which is placed over it, and which contains another dozen eggs. Three wires twisted as Fig. 1 and placed triangular fashion as indicated by Fig. 3, hold each egg; thus, thirty-six wires and four uprights will be necessary to carry each dozen eggs.

Cleaning Cuckoo Clock.—A cuckoo clock is a most difficult clock to clean properly; indeed, valuable cuckoo clocks have been entirely spoiled by having been tampered with by inexperienced persons. To do the work, commence by drawing out the pin and then unscrew the brass nut that holds the hands; remove these, then the four pins that hold the dial in place, and the two doors, and draw out the wire nails holding the back to the movement. This will then be clear, and the small door opened and closed by the bird being removed, the works should be well studied. Note how the bird is sent out and how the tilting motion is given to cause its mouth to open and its wings to spread. The slender wire fixed to the left-hand bellows does this, and a lever near the bottom of the rod on which the bird is fixed causes it to go out, calling "cuc" "coo," and then allows it to return. A rough sketch of the various parts will help in putting the whole together, because, unless the five lever bars at the left-hand side are in their proper places, it will all be out of order. The lowest bar has a wire upright which lifts the right-hand bellows, the next lifts the other bellows, and the bar above is the hammer to strike the gong which accompanies the bird's calls. Another lever counts on the count wheel the number to be called, etc. The difficulty lies in this mechanism, but after study it may be managed. Use a thin piece of card to clean out the dust which will have accumulated in the cap part opposite the lips of the pipes. The going part is like that of all other clocks, and so need cause no trouble. Replace the chains, then fix on the back with the gong attached and the dial, making the hands agree with the hour struck, and replace the small door on the front part with wire attached to the pedestal of the bird. Oil all the pivot holes, giving a drop to each and to the tips of the bars and each pallet, and one drop to the clutch where the pendulum works in the loop. Use special clock oil from the clock material shop, not machine oil.

Blueing Spectacle Frames.—To blue spectacle frames after brazing, clean up with the finest emery cloth, and if the frames require re-blueing in one spot only, warm them very gently over the flame of a spirit lamp, watching the colour change and leading the blue along the frame. This requires quickness and skill. If the first attempt is a failure, clean off and try again. To blue the frames all over is more difficult, and is done by opticians in hot charcoal dust. A heap of this is placed in an iron pan or a shovel, and is then ignited by a blowpipe, or by placing the pan until it becomes partly red-hot over a gas burner. When the charcoal dust begins to glow, stir it up with a metal rod and blow it gently till it is all glowing and smouldering. Then insert the spectacle frame, stir it about for a moment and withdraw, watching the colour, and repeatedly inserting it until correct. Further instructions on blueing articles of steel are given in Series II., pp. 82 and 89.

Hot-air Flue and Water Circulation in Incubator.—The hot-air flue may be a straight piece of copper pipe about 2 in. in diameter carried through the water in the circulator and reaching from the bottom of the circulator to the top; about 1 in. from the top of this pipe the hot-air flue is taken off, and is carried round inside the tank and through the water. The circulator itself has at the top of its side a 3-in. hole. A piece of copper pipe 3 in. in diameter and about 4 in. long is fixed over this hole; a 3-in. hole is cut in the side of the tank, and the other end of the 3-in. pipe is fixed over the hole in the tank, thus allowing ½-in. space between the outer and the inner tubes. Water, when heated, naturally rises to the highest point; therefore the hottest water in the circulator flows into the tank through the upper portion of the 3-in. outer tube. The cold water in the tank now comes back through the

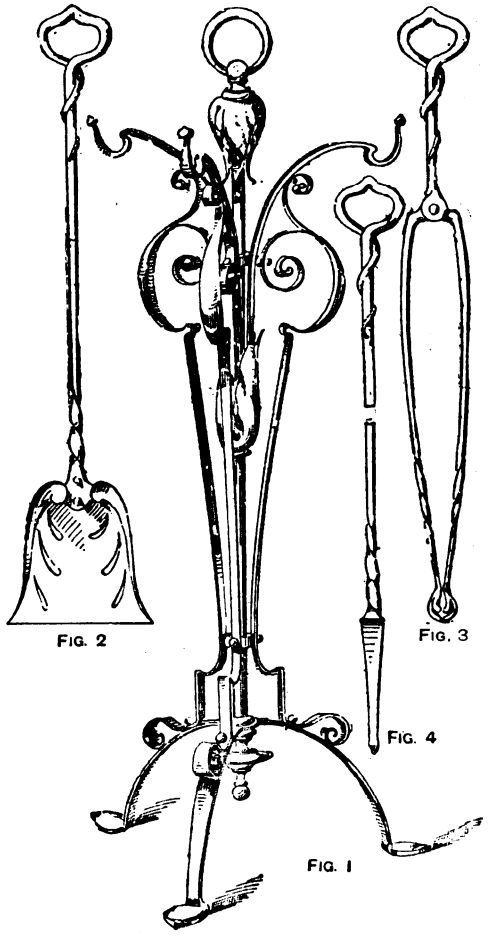


Hot-air Flue and Water Circulation.

bottom part of the 3-in. outer tube, and so circulation is maintained in this manner all the time the lamp is alight. As the water is constantly on the move, cold water cannot be found in any part of the tank. For a detailed sketch of the circulator, see the accompanying illustration. The top of the circulator must be domed as shown, and an air-tap placed at A, the highest point, which will be about the centre of the dome. If the water becomes air-locked, circulation becomes impossible; this tap must therefore be left open when the apparatus is being filled, and also when the apparatus is replenished. The top of the tank should also be the highest point, and there also an air-tap should be provided.

Repairing Broadwood Table Piano.—In the case of a Broadwood table piano in which several hammers are broken, observe the following hints in removing the action for enabling the old coverings to be taken off. The key-board and hammer action is self-contained, and is sometimes in two sections, the largest portions extending from the extreme bass end to a support for the sound-board. This forms a division extending from the sound-board to the base board or floor of the piano, and the smaller portion extends from this division to the extreme treble end. Dampers are attached to the larger portion only. The hammers and hammer levers are hinged on rails supported on standards fixed in the ends of the key frame. To withdraw these, take out the maker's name-board by pulling upwards; it slides in a channel at each end. Next remove a thin slip of wood that fits into a groove immediately in front of the keys. This is rarely screwed in, but fits tightly; but if necessary, prize it up with a chisel or the point of a screwdriver. The larger portion of the key-board should now pull forward, and should be taken right out before withdrawing the small portion. The hammer stems are in two sections, the longer part, to which the hammer head is attached, being vellum-hinged to a short section which is glued to the hammer rail. A thin strip of mahogany is generally screwed over these short sections for greater security and to give a neater appearance. If the felt covering of the hammer heads is so badly worn as to need re-covering, it will be more satisfactory to re-cover the whole set; for this purpose a cheap hammer felt will be quite suitable. The old covering (felt only) and vellum or leather hinges can be readily removed by softening the old glue by pressing a strip of hot flat iron against it. When re-covering the hammer heads the felt will require bevelling along the edges, and the portion covering the tip of the hammer head should be left untouched by glue. Bind tightly with tape, securing the two ends of the felt at one operation. Vellum or leather for hinges may be procured in small quantities, or the requisite material in calf leather can be stripped from the cover of an old account book; if vellum is required, a piece of old banjo head will do.

Wrought-iron Fireirons and Stand.—The custom of resting the fireirons on dogs is being replaced by the fashion of hanging them on a stand placed on one side of the chimney corner or hearth. Fig. 1 is a design for a

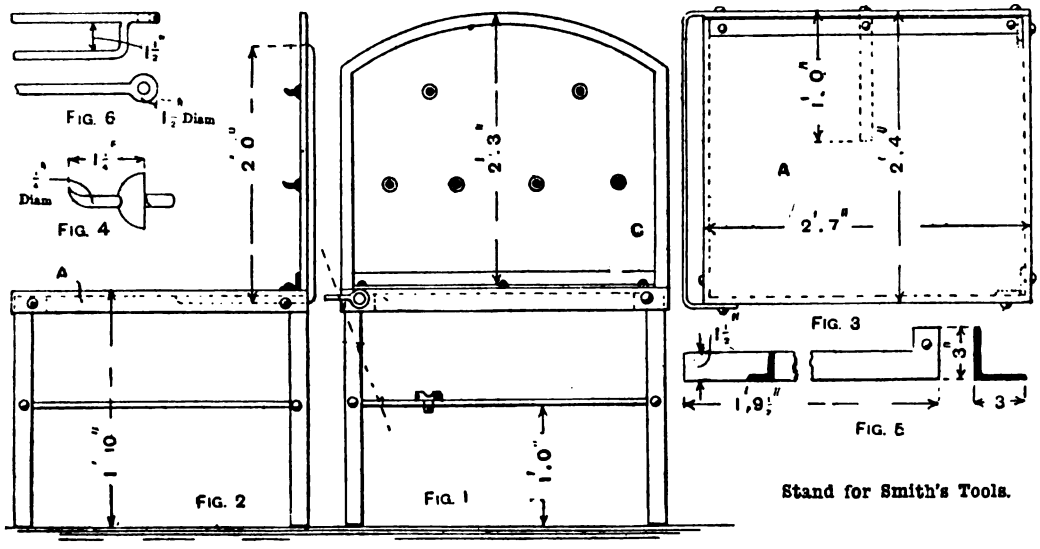


Wrought-iron Fireirons and Stand.

stand, fairly simple in character and suitable for execution in wrought-iron, and it would look very well indeed if finished "armour bright." The fireirons (Figs. 2, 3 and 4) would be better if specially made, and designs are given; but if preferred they may be bought and simply provided with rings at the top to suspend them from the stand. The feet of the stand should spread sufficiently to prevent it being easily upset.

Uniting Rubber Tube to Vulcanite Tube.—To join a piece of vulcanite tube to a piece of indiarubber tube, adopt the method described below. If the tubes are of the same size, the junction should be made by a short piece of brass tube, the outer diameter of which is equal to the inner diameter of the tubes; the tubes may be wired on for further security. If the vulcanite tube is the larger of the two, the joint may be made with a tapering brass tube; but if the rubber tube is the larger, it may be drawn over the vulcanite tube and, if necessary, wired. In all of the cases described above the joint would be quite waterproof.

Stand for Smith's Tools.—Figs. 1, 2, and 3 show the elevations and plan of a useful stand for a smith's tools. The top A (Figs. 2 and 3) may be a piece of an old surface plate cut to the dimensions given in Fig. 3. Otherwise, the top may be cast, or can be made from ½-in. plate with three pieces of 2-in. angle iron riveted on for strength In any case, a light cut should be taken over it in the planing machine, as it is then of use for levelling light work. The back is of ¼-in. sheet iron cut ¼ in. short to allow ¼ in. at each side for the thickness of the angle iron stiffening C (Fig. 1). This is made from light L-section, say 1 in. by ½ in. by ¼ in., and is bent to the shape of the back plate, to which it is secured by ¼-in. countersunk rivets. The position of the small hooks (for hanging callipers, etc.) can be seen in Fig. 1, and a detail drawing of a hook is given at Fig. 4. The back is secured to the table by a bracket of 1¼-in. half-round iron shown in Figs. 2 and 3. This should be riveted to the back, and bolted to the under-side of the table by countersunk bolts. For further security a piece of 1½-in. by 1½-in. angle iron is bolted with ⅜-in. bolts in the position shown in Fig. 2, the flange extending round three sides of the table only, the back being bare. The legs (Fig. 5) are made from 1½-in. angle iron, and may be without the lugs shown on the end, but the job will not be nearly so strong. Holes should be drilled in the lugs for ½-in. bolts. Figs. 1 and 2 show, about half-way down the legs, two tool racks for bottom tools. These are placed one at the front and one on the right-hand side, and are made from ½-in. square wrought-iron, the ends being welded and bossed as shown at Fig. 6. The racks are held in position by ½-in. bolts. Figs. 1 and 3 show a single rack on the left-hand side; this is for holding setts or top tools, and is made from ½-in. square iron with an eye turned on each end large enough to slip over the leg bolts, which must, of course, be long enough. Note that the rack is not on a level with the table, for by putting it lower the handles of the tools are caused to cant as shown by the dotted line in Fig. 1, and this keeps them out of the way of the smith's feet.



Stand for Smith's Tools.

Tinting Colours for House Painting.—The colours named of which notes are given below are so arranged, when mixed, as to be permanent in ordinary circumstances when used in house painting and decorating. White-lead, which is the principal pigment employed by the house painter, may be mixed with nearly all colours with the exception of those containing sulphur, as lime blue, ultramarine blue, and cadmium yellow. Zinc white may be mixed with all other pigments. Its want of body or covering power is its chief objection. Ultramarine, royal, and lime blues may be compounded with zinc white without the colour being affected. Brunswick or celestial blue, which is of a deep shade, may be prepared in a variety of pale and intermediate shades with the addition of white-lead, and may be deepened with Prussian blue or drop black. It should not be compounded with ultramarine blues. Brunswick greens may be lightened with lemon chrome or deepened with brunswick and Prussian blues; with the addition of lampblack, umber, and yellow ochre in variable proportions, sage, bronze, and olive greens may be produced. Chrome greens may be tinted in a similar manner to the brunswick greens. Emerald green may be lightened with white-lead or chrome yellows and deepened with brunswick or Prussian blues. Chrome and zinc yellows may be lightened by the addition of white-lead and zinc white and darkened with orange chrome, yellow ochre, raw sienna, burnt sienna, and the umbers. Yellow ochre may be lightened with chrome yellow and white-lead, and deepened with raw sienna, raw and burnt umber, vandyke brown, oxides, Indian red, and drop black. Vermilion may be lightened by adding white-lead, zinc white, orange, and red-lead, and deepened with carmine, madder red, and most other pigments without being chemically affected. Venetian red and the oxides may be lightened with white-lead, zinc, red and orange lead and vermilion, and deepened with Indian red, burnt sienna, purple brown, blue, and ivory black. Indian red may be lightened with red oxide, white-lead, signal red, and deepened into a chocolate or brown by the addition of ivory black or drop black in variable proportions. Brown pigments as raw and burnt umbers may be lightened by the addition of white-lead, zinc white, yellow ochre, and orange chrome; almost any shade of grey or drab may be produced by mixing in variable proportions. Brown pigments may be deepened by the addition of drop or ivory black. The above are given in most cases without the addition of black, as this deadens the tints somewhat. Black may be added if required without chemically affecting the pigments.

Cleaning Horsehair.—The following is the method of thoroughly cleaning horsehair adopted in the cleaning mills. The hair is placed in a large wire cage, which is put into a steam jacketed boiler. Water is then pumped into the boiler, the boiling lasting about half an hour. The cage is then removed to a hydro-extractor, also known as a "whizz," the hair being dried by high speed centrifugal action. The hair is passed once or twice through the teasing machine and is then ready for use. Doubtless a modification of the above process may be made to suit the amateur's requirements. New horsehair in the natural state goes through exactly the same process before being placed on the market for stuffing purposes.

Thinning down Carriage Varnish.—To thin down 1 gal. of old carriage-body varnish that has gone rather stiff, and dries very slowly, adopt the following method. Place it over a gas stove or ring, and warm the varnish slightly until it becomes of a thin nature, and add to it ½ pt. of pale strong terebine, ½ pt. of pale gold-size, and about ½ pt. of American turpentine. Allow this to remain over the stove several minutes, continually stirring. Then remove it, and allow to cool down; use it in the ordinary way. The materials added to the varnish should be pale and of good quality, otherwise they will darken the varnish and make it unfit for delicate colours. The quantities of gold-size and terebine stated above should not be exceeded, otherwise the varnish is liable to deteriorate in durability and to crack when used on outside work.

Softening Snake Skin.—To soften a snake skin, damp the skin in salt water till it is soft, and with a blunt knife scrape off all the fat and flesh; to do this, the skin should be placed on a circular piece of wood. Then make a solution in 4 oz. of water of 1 oz. of alum and as much salt as the water will contain. For dissolving the alum the water must be hot. When cold, immerse the skin in this, and let it remain for forty-eight hours; it will then be cured. Now remove it from the alum bath, well pull it about, and stretch it out well, nailing it on a board to dry.

Folding Shafts for Mailcarts.—Fig. 1 shows in side elevation one shaft of a mailcart. So that it may fold, the shaft is cut and fitted with a hinge A at the top and a plate B at the bottom, so that, by taking off the fly nut C, the portion D of the shaft can be swung back out of the way when necessary. The hinge shown in plan by Fig. 2 is 6 in. long, the width at the ends being about ¼ in. The width at the centre should be equal to the width of the shaft at that part. The four countersunk holes take the fixing screws, and two holes E, ⅛ in. in diameter and 1¼ in. from the centre, take the bolts (see Fig. 1). The plate B is shown in plan by Fig. 3, and it is 6 in. long and ¼ in. thick, and is equal in width to that of the shaft. It has two countersunk holes, and a hole F, ⅛ in. in diameter, for the left-hand bolt (see Fig. 1). At the right end is a slot ¾ in. wide and 1 in. long, in which the bolt at C slides when the shaft D is let down. The plate B is fixed at the bottom so that the dotted line in Fig. 3, which is 2 in. from the end, lies under the joint, ⅜-in. bolts and nuts being inserted as shown. All the fittings look best if made of brass. Another method of accomplishing the same object is to place the shafts as shown by Fig. 4, and hold them fast by a bolt and fly nut

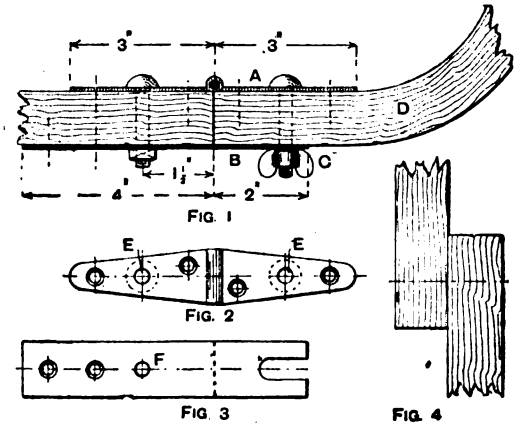


FIG. 1

FIG. 2

FIG. 3

FIG. 4

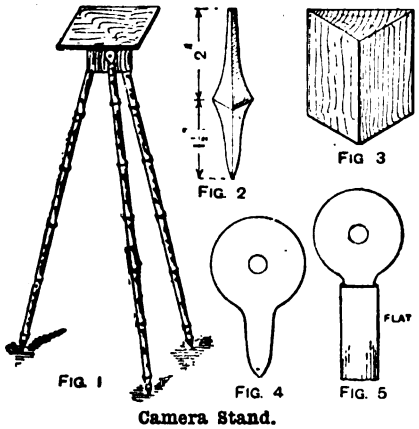
Folding Shafts for Mailcarts.

through the centre. This simple method, however, has several disadvantages. In the first method there is a tendency for the shafts to be less rigid, in which case an extra stiffener could be put in near the handles.

Altering Benzoline Blowpipe to Burn Paraffin Oil.—A burner constructed for use with benzoline cannot easily be converted to a paraffin burner. The two most important points to be considered in the alteration are that the tubes in which the oil is converted to a gas must be so arranged that they are subjected to a higher temperature for use with paraffin (owing to the vaporisation point of paraffin being higher than benzoline), and the inlets in the flame tube or ring through which air passes to mingle with the vaporised hydro-carbon must be larger for paraffin than for benzoline. The cheapest method of conversion would be to buy a new burner of the power required for use with paraffin, and attach this to the supply tube of the lamp.

Setting Out Buttoned Upholstered Work.—The standard size for a finished diamond-shaped tuft is 7 in. by 5½ in., and usually this would be set out on the material or skin as 9 in. by 7¼ in., thus allowing 2 in. in length and 1¾ in. in breadth for fulness. No hard and fast rule is observed, however, as if extra depth is required, 2½ in. would be allowed, depending on the materials used. To set out, lay the skin on the bench, and mark the outline of the seat. Always have the neck portion to the back when covering seats. Mark out a centre line, and from this mark parallel lines 7¼ in. apart; cross-mark these lines with spaces 9 in. wide, and the diamonds can then be marked in and creased, setting them in by lightly hammering on a lap iron. No buttons should come any nearer than 2½ in. or 3 in. from the seat edge. In working common roans, it is necessary to glue small pieces of calico or leather clippings underneath the joints of the diamonds to prevent the twine cutting the skin when tying down. Commence by tying down the centre button, and fill up each tuft to a good swell, and keep the plaits as deep and tight as possible. The plaits at the edges must lie square with the edges, and be tacked to the stuffing rail. In setting out deep tuftings for curved work, it will be necessary to allow double the fulness given above, on account of the curve being quicker and the surface larger after being stuffed.

Camera Stand.—Fig. 1 shows a light, cheap, camera stand or tripod, constructed for the special purpose of supporting a hand camera whilst photographing architectural subjects. To construct it, obtain three bamboo rods, all about 4 ft. long, and cut them in such a manner as to obtain a joint at the ends, which will eventually be nearest the ground when the stand is in use. Next get three pieces of iron, about ¼ in. square and 3 in. long, and draw each into a spike as shown in Fig. 2. Fix an iron spike into each rod; the joint prevents splitting if the spikes are driven carefully. The portable head is of wood, and Fig. 3 shows a triangular prism, which measures 1¼ in. each way, and which is preferably of baywood, as it is light and holds screws well. On the top of this prism fix a piece of board of such a size as will easily support a hand camera; a piece 5 in. square by ¼ in. thick is used to support a quarter-plate camera. To fix the rods, take three pieces of brass tube, 2 in. long and of such a diameter as to allow the rods to fit without having to pare the ends, say ¼ in. internal. Next cut out three pear-shaped pieces of sheet-iron, ⅛ in. thick, as shown

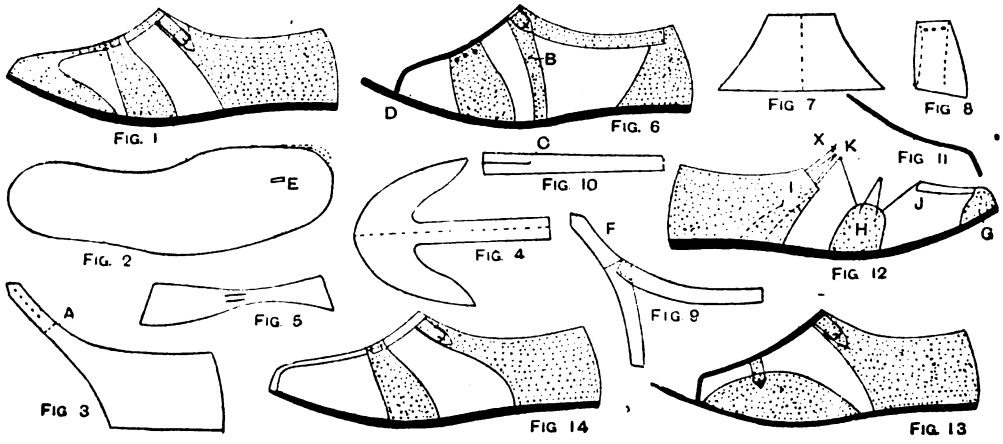


Camera Stand.

in Fig. 4, and drill a hole in each piece. Now the brass tubes should be taken, and one end of each squeezed flat for about ¼ in. in a vice, leaving just sufficient room to allow the narrow end of the pear-shaped pieces of iron to enter about ¼ in. Clean the iron and brass, and firmly solder them together, as in Fig. 5, using killed spirits and a rather hot bit, which will cause the solder to flow into the inside of the tube and thoroughly sweat the two pieces together, the superfluous solder being wiped away with a cloth. Screw a piece of tube to each side of the triangular prism of wood, so as to allow them to move in the same plane as the side to which they are fixed, insert the bamboo rods, and the stand is complete. It may quickly be set level by the legs, sighting over the top of the board, and bringing it in line with a string-course, window head, or any other horizontal line of the building. By pulling the head away from the rods, the stand is very portable, for the head can be put in the pocket, and the rods kept together by two indiarubber rings. The weight of this stand complete would be between say 1 lb. and 2 lb., according to the size.

Crimson and Green Dyes.—For 10 gal. of red dye to be used for worsted, boil 4 lb. of cochineal with 2 gal. of water and strain, then add 3½ lb. of quercitron extract, 3½ lb. of oxalic acid, 1½ lb. of cream of tartar, and 8 lb. of chloride of tin solution. The worsted may be placed in this solution cold and heated to boiling for one hour. For 10 gal. of green dye, take 5 lb. of sulphate of indigo, ¾ lb. of picric acid, 15 lb. of alum, and 5 lb. of sulphuric acid, and mix with water in a wooden vat. The worsted, after being dyed, should be washed several times in cold water to remove excess of colour, etc.

Sandals.—The designs in sandals here given will form a groundwork for almost any shape desired. Fig. 1 shows a capped sandal, and is perhaps one of the best forms, as there is not much chance of the toe tripping with it. Fig. 2 is a sole shape, the full outline of which is the best shape for such work, but modifications can be made as shown by the dotted lines. The parts of patterns for this sandal are illustrated in Figs. 3, 4 and 5. Fig. 3, for the outside quarter, can be cut only to the line A, as the buckle goes here and the other piece forms the strap. Fig. 4 can be cut on the double, like a toecap pattern, and the same applies to Fig. 5 also, but one side must be wider than the other for the outside joint. This sandal could also be cut with the back as shown in Fig. 6, which may be with or without the centre strap B. The parts of this sandal are illustrated in Figs. 7, 8, 9, 10, and 11, Fig. 11 being Fig. 10 folded from the point C, and ready to be placed and sewn in a slot cut in the sole D (Fig. 6), as also shown at E (Fig. 2). In Fig. 9, for the outside the piece F is dispensed with, the buckle being there. Fig. 7 is cut on the double, and so is Fig. 8, but it must be wider at the centre and then cut in half, to admit of lacing together. The form shown in Fig. 12 can have almost any sized back as shown by dotted lines; it has a piece on each side and a toecap, in the centre of which two holes are punched and a lace is put through, the two ends being just linked in each other at J at a convenient distance from the cap G, and then threaded through H,



Sandals.

at the hole near the toe, brought to the centre, linked again, and then put through the second hole in H. Then when the sandal is on the foot these ends of lace are crossed on top of the instep to the reverse side, put through the first hole at I, over the instep again, put through the second hole, and finally tied at K. The forms shown in Figs. 13 and 14 can easily be cut from instructions given above. For sets of patterns, only alternate sizes will be needed; for instance, in children's sizes, 10 to 13, only 10 and 12 would be wanted.

Watch Balance Spring Collet.—To make a watch balance spring collet in brass, the method is to take a length of brass bushing wire with the central hole a little too small to fit on the balance staff. Hold it in a wire chuck in a watch lathe, or put it between centres in the turns, and rough out the collet to the correct diameter, and a little thicker than necessary, without cutting it off the end of the bushing wire. Then drill the hair-spring hole, taking care that it is truly at right angles to the wire. Cut the collet off, and broach out its centre hole to go nearly home on the staff. Then slit it with a slitting file, and place it on a turning arbor in the lathe or turns to finish. Use a polished graver, as this will leave a polished cut. Cut the collet down on its under side until it goes so far on the staff that the hairspring hole is level with the hole in the stud in the cock so that the hairspring will lie flat. Then cut the top surface down to the correct height, and put a neat bevel on each edge.

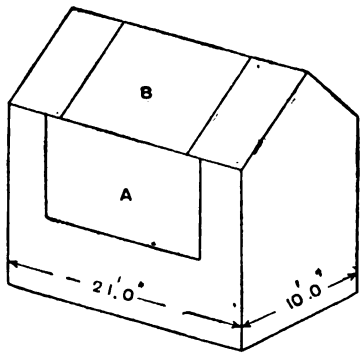
Upholsterers' Flocks.—Flocks are the waste products of the various machines in spinning and preparing woollen and cotton threads for the loom, and in finishing the cloth for the market. The best flocks are cut or cropped from the face of heavy woollen cloths, and these are nearly all purchased for working up again into cloth with a mixture of long stapled wool or cotton, the cloth produced from the latter being known as "union." The commoner varieties of flocks used for upholstering purposes are here described. Mill-puffs are a "union" flock, grey or mottled, and possessing very little curl; they are principally used for cheap furniture stuffings, etc. Teazed wools are a pure wool flock, but are a bad colour, with no curl, and are manufactured from the fluff and sweepings of the mills; they are very cheap and warm. Black wools are in many different qualities and colours, and are chiefly made by the combing machines used in wool carding; they are of medium curl, are much used for mattress stuffings, and are often blended with coloured flocks and sold as "red spot fancy," mottled mixture, brown mixture, etc., the name denoting what colour has been blended with the black. White wools are a pure wool flock with a full curl and soft elastic feel, which in ordinary circumstances will last for years without matting; an average sample will cost 1s. per lb. Flock manufacture is usually carried on as an adjunct to a woollen mill, the woollen waste being sorted on large wire grids, which allow the dust and powdered material to fall through. The better qualities are dyed, dried by heat, and passed into a "willowing" machine, which beats and opens all the fibres. They are then passed into a curling machine, and blown out by compressed air, and afterwards packed in 50-lb. bags for the market. The short stapled powdered flocks are used to make flock wallpapers, and the dust is sold to farmers for manure. Two machines are required, a "willow" and a curling machine, and an average size machine will require one horse-power. If the willow is for redressing old flocks, allow 25 per cent. more power, as some flocks are very badly matted. A high speed will be found necessary.

Re-blacking Sliding Tubes of Telescope.—To re-blacken the sliding tubes of a telescope from which the black has worn off, mix a little vegetable black and some gold lacquer in a saucer to the consistency of paste, and thin the same by adding methylated spirit. Separate the tubes, and with a pencil brush carefully paint the chipped places. This operation is better performed with the tube slightly heated over a Bunsen burner, but as the outsides of the tubes do not need repolishing, it is better to apply the dead-black cold. When applied cold, the spirit takes somewhat longer to evaporate, and it is necessary to wait and see whether the black has taken properly. If not, a second or third application may be needed.

Photograph Buttons.—In making celluloid buttons containing photographs, ordinary prints are first prepared. These prints (either silver albumen, P.O.P., or bromide) are made in the usual way, and after fixing, washing, and drying, may be mounted face down with starch or gelatine on to sheets of celluloid sold for the purpose. If necessary, the photographs may be mounted before they are dried. When dry the photographs are stamped out with a circular or other shaped cutter like an ordinary punch. The print is then placed in a machine with a metal disc and stamped into a button. After this the bent pin, strut, or frame is attached. The process and the machine are extremely simple and can be worked by anyone. As two blows only suffice to complete the button, an enormous quantity can be turned out in a day with one machine.

Oxide of Iron Paint for Ironwork.—Before applying oxide of iron paint on ironwork, it is necessary that the work first receive one or two coats of red-lead mixed with boiled linseed oil. This forms a harder and more elastic priming than any other protective paint, and adheres firmly and allows for the contraction and expansion of the metal. Red-lead requires no driers, and when mixed with linseed oil the two react chemically and form linoleate of lead. Red-lead has been found (by the experience gained in painting large structures such as the Forth Bridge) to be superior to any other pigment for the protection of metal work. Oxide of iron paint is a good paint for the same purpose, but is in no way equal to red- or orange-lead. The oxide may be used for toning down the aggressive colour of red-lead, or may be employed as a finishing coat, and for this purpose the oxide should be mixed with a little patent driers, thinned down with 3 parts of boiled oil and 1 part of oak varnish. Turpentine should only be added in very small quantities when the paint drags. Red oxide of iron should be tested for fineness by rubbing with oil on a piece of glass, and for depth of colour or purity by mixing various samples with given weights of white-lead. These test samples should be mixed in oil and placed side by side: the sample possessing the deepest colour will be the strongest stainer and the purest.

Photographic Studio.—In constructing a portable studio 21 ft. by 10 ft., for portraiture, the side light A should be about 14 ft. long, leaving about 3½ ft.

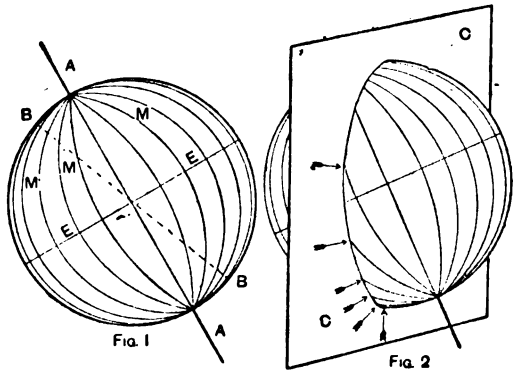


Photographic Studio.

unglazed at each end. The top light B need not be more than 12 ft. long. The accompanying illustration shows a good form of studio.

Deodorising Badger Skin Rugs.—To deodorise a large rug made of badger skins, remove the lining, lay the rug on the floor with the hair side down, and cover the skin side with a layer of dry powdered charcoal; charcoal has long been known as a deodoriser. Allow the rug to remain for a few days in an open airy place, then brush out the charcoal, and ascertain whether it has effected the desired purpose. To prevent recurrence of the objectionable smell, sprinkle the flesh side of the skin with a little carbolic acid. Care must be exercised in using the carbolic acid, as it is not only poisonous, but will raise blisters on the skin.

Arranging Sundials out of Meridian.—The following is a practical method of drawing the hour-lines on a sundial. Take a sphere 3 in. or 4 in. in diameter (a child's rubber ball will do excellently) and draw lines on it as if it were meant to be a model terrestrial globe; that is, mark two poles at opposite ends of a diameter, and draw the equator E (Fig. 1), dividing it into twenty-four equal parts; then draw a meridian M through each division of the equator. Push a straight wire as A through the ball, entering at one pole and coming out at the other, and projecting both ways. Fasten one end of the wire in any temporary support in such a way that the wire points due North, that is, to the pole star; then turn the ball on its axis till one pair of meridians is in a vertical plane. The ball must remain rigidly in this position. It may be here stated that if the model globe be placed in sunlight in the position described above it will serve as a sundial for any place, the time of day being read on the equator where the line at B separating light from shadow crosses it. The intersection of the highest and lowest meridians with the equator, in this case, will give 6 o'clock, morning and evening, and the following intersections give 7, 8, etc. To proceed with the ordinary plane dial, take a sheet of thin cardboard and cut out of it a circular disc of the same diameter as the ball. The ball must fit into the hole so stiffly that the card may be turned into any position without falling off. Place the card on the ball (the ball being halfway through the hole as in Fig. 2), and make the card C stand exactly as the wall does to which the dial is to be attached. Slide the ball in the hole if necessary till a pair of meridians is vertical, and finally see that the wire still points true North. Now, as shown, mark on the card the points where the meridians on the ball pass through, remove the card, and in the hole replace the piece cut out. Draw lines from the marks round the hole to the centre of the cut-out circle, and these will be the hour-lines of the dial. The hour-line corresponding to the lowest meridian will be that for 12 noon, if the face of the dial is to be vertical. Of course, only about half of the lines will be of use on any dial. The edge of the gnomon must lie in the same direction as did the wire axis of the model globe. If the gnomon be of appreciable thickness the card templet used for drawing the hour-lines must be divided into two along the noon line and the halves separated by the thickness of the gnomon before transferring the lines from the templet to the actual dial. This method of drawing the hour-lines of a sundial is applicable to all positions of the dial except when its face is parallel to the axis of the sphere, as, for example, when the dial is to face due East or West.



Arranging Sundials out of Meridian.

For this case the diameter of the circular hole in the cardboard should be a little smaller than that of the ball. When the card is applied to the ball the meridians which are cut will be intersected in two points each. The card being marked and laid down with the disc which was cut out re-inserted, the two marks corresponding to each meridian should be joined by straight lines drawn on the disc. These are the hour-lines. The shadow-giving edge of the gnomon must, as before, lie in the position which the axis of the sphere had with respect to the card when it was held against the ball. If the size of the dial be not suitable all the dimensions can be altered to any given scale.

Slating Roof with Westmorland Slates.—Westmorland slates are thicker and coarser than Welsh slates, but are hard, tough, and very durable. These slates come from Ambleside, Langdale, and Thang Crag at Windermere, are distinguished by their dull green colour and rough surface, and may be obtained in various sizes, like Welsh slates. The slates are laid upon battens or boarding with the usual lap and gauge and in the usual manner, but when of large size and considerable thickness may be economically laid in the manner described below. "The rafters are placed at a clear distance apart, about 1½ in. less than the width of the slates. Down the centre of each rafter is nailed a fillet, thus forming a rebate on each side, in which the edges of the slates rest, being secured by black putty, or (as this looks smeary and uneven) by a second fillet 2 in. wider than the first fillet and nailed over it so as to cover the edges of the slates and hold them down. Each slate laps about 3 in. over the slate below; only half the number of slates is required in this method as compared with the ordinary method of slating, and no boarding or battens are necessary." If the slates vary in length, the longest should be used at the eaves. If the slates are found to vary in width, the same width must be used in vertical lines up the slope of the roof, but horizontally the slates may be used alternately long and short.

Paste for Papering Lime-washed Walls.—The following recipe makes a strong paste that may be used for a variety of purposes where strength is required, and is excellent for use on lime-washed walls and damp walls. Soak ½ lb. of glue for several hours in cold water, then dissolve in 1 pt. of boiling water, and whilst hot add, stirring briskly, ½ lb. of Venice turpentine. In another vessel make 2 lb. of flour into a paste with 1 qt. of cold water: beat up the paste until it is free from lumps, mix the glue and the flour paste together, and thin down with 1 gal. of boiling water, stirring briskly during all the mixing operations.

Home-made Acetylene Generator and Lighting Apparatus. — The illustrations show an acetylene generating and lighting apparatus. The main part is of zinc, the dimensions being indicated in Fig. 1. The carbide holder is an improvised tin canister with the bottom removed and a truncated conical portion soldered on in its place (see Fig. 2). The soldering line A (Fig. 2) is kept lower than the line of connection with the top of the gasholder, to avoid undoing one joint while making the other. The outlet at the bottom of the main cylinder is a brass screw cap, to be purchased at any ironmonger's. The ⅜-in. rod B is of iron and fits into a wooden cone C in the carbide holder, the under side of the cone being lined with a rubber disc D, ⅛ in. thick, which serves to make a fairly gas-tight joint at the sides. At the bottom end of the rod a lead weight E (Fig. 1) is attached, which answers the double purpose of creating pressure in the gas cylinder and of making a good joint between the rubber and the sides of the carbide holder. The fittings at F are ordinary house-supply gasfittings, and H is an outlet. In charging the carbide holder a short length of wood is inserted at G between the top of the water cylinder and the rim of the gasholder, before undoing the lid. Unless this is done the dome would immediately begin to sink, thus expelling any unused gas, as soon as the lid was taken off. The apparatus has worked very satisfactorily indeed, the only difficulty being leakage. At the junction of the lid in the carbide holder it has been found necessary to apply vaseline with the object of preventing leakage, and a large screw-topped chamber is suggested in place of the one shown. Though very simple in construction, the apparatus is perfectly safe. The only danger to be apprehended, if all the parts are made to work smoothly, is that its top-heaviness will render it liable to be knocked over. This must be provided against by attaching suitable feet with provision for screwing to the floor. When the gas begins to be generated the tap should be turned full on, and the burner tried from time to time with a light. The holes in the burners are very small, and it will take some time for all the air to be cleared out of the tubes. When eventually the gas begins to light, the flame will be yellow and noisy, gradually settling down into a beautifully clear and steady white flame. The burners, placed three or four in series with a suitable reflector (see Fig. 3), give an excellent light for general lantern work and for all ordinary illumination purposes, but are liable to bring considerable disappointment in critical optical work. The apparatus under discussion was specially intended for photomicrograph work, but its actinic effect was infinitely poorer (in comparison with its apparent brilliancy) than that of a good paraffin lamp. It has been stated that for cinematograph projections the light could be made to give a 10-ft. picture, but the writer has not yet seen a picture 5 ft. in diameter that was any good, not even with four good burners and an excellent machine. The 00000 Bray burner (Fig. 4) gives a very steady, clear light, but the two other forms shown in Figs. 5 and 6 persisted in "flaring up" or else in giving a small and altogether worthless flame. These three are specially mentioned as being amongst those most frequently advocated by retailers. If possible, the apparatus should be kept out of doors. Care should be taken, when the water is poured away or agitated in any way, not to bring a flame near to the vessel.

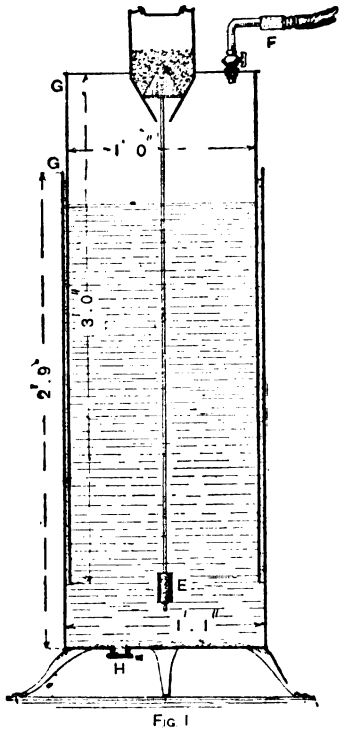


FIG 1

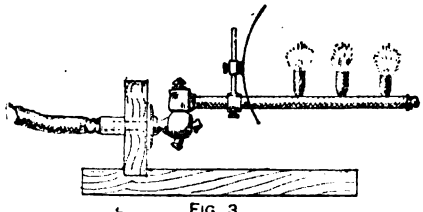


FIG 3

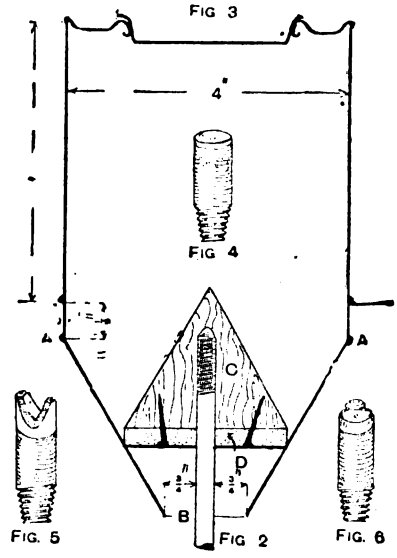


FIG 4

FIG. 5

FIG 2

FIG. 6

Home-made Acetylene Generator and Lighting Apparatus.

Protecting Hammer Handles.—Handles of heavy hammers, such as sledge-hammers and scaffolders' hammers, are liable to injury if the head misses the point aimed at, the force of the blow being received on the handle. One way of protecting the handle from injury by such accidents is to bind it tightly round with No. 18 gauge copper wire. Fasten down the end of the wire with a small staple, and solder over. Only about 5 in. just below the head need be bound. Another way is to sheath the handle in No. 16 gauge sheet copper. Allow about ½-in. lap, solder, and then put in two or three screws countersunk down. Use resin as a flux, and remember that when soldering copper, especially when the flux is resin, the work should be done quickly.

Thicknesses of Circular Saws.—The following gauges will be suitable for circular saws that have to do general work, in both hard and soft woods:—18 in., No. 15; 24 in., No. 14; 30 in., No. 13 T; 36 in., No. 12; 42 in., No. 11; 48 in., No. 9; 54 in., No. 9 T. Larger saws should increase correspondingly in thickness. With care, all ordinary sawing can be satisfactorily done with saws of the thickness given. Where T stands against the No. it denotes tight to the gauge. Saws to cut soft wood only should be easy to the above gauges. In fact, a careful practical operator can work them a gauge less in thickness. For cutting exceptionally hard dry wood, saws should be tight to, or even one gauge stouter than, the gauges above. A suitable lead in the teeth for ordinary hard and soft wood sawing will be to an angle of 65° to 70°, or 20° to 25° from the diametrical line; for cutting soft wood only, 30° to 35° to the diametrical line, and for exceptionally hard wood 10° to 15° to the diametrical line, or an angle of 80° to 85°.

Box Solitaire Board.—Solitaire is one of the very few games that a person can play alone. A convenient form of board on which to play the game is illustrated herewith, Fig. 1 being a part section of the box closed, and Fig. 2 a part elevation of the box open for play, the cover being off and placed underneath, where it is held in place by the step turned on the bottom of the box. Any hard white wood is suitable for making the board and cover, and should be turned to the sizes given. Then thirty-seven holes are marked out inside the bottom as shown at Fig. 3, and bored $\frac{1}{16}$ in. smaller than the

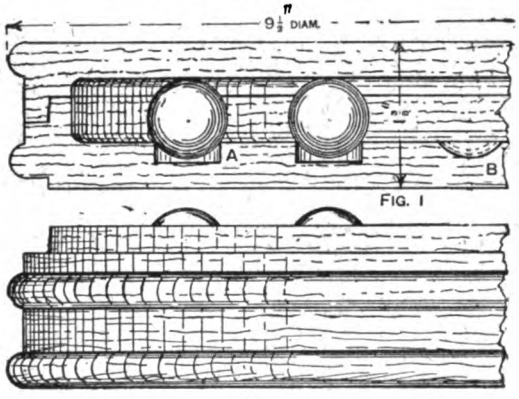


FIG. 1

FIG. 2

Box Solitaire Board.

marbles or glass "alleys" to be used, as shown at A (Fig. 1). This holds them firmly in place and yet allows them to be easily lifted for play. The holes may be scooped out with a gouge to fit marbles if preferred, as shown at B. The top should be made just to clear the marbles when it is on, and it will then hold all of them in their places. The game is played by taking out the centre marble and jumping one of the marbles over another into the blank space, the marble jumped over being taken up as in draughts. This is continued until all the marbles are taken away except the last one, and it is necessary to leave this one in the centre hole. Other variations of the game are played, and some amount of skill is required to negotiate even the game described.

Repairing Holes in Galvanised-iron and Brass Vessels.—To repair holes in a vessel made of galvanised-iron, thoroughly clean the metal at the part to be soldered by scraping with a suitable sharp-edged tool, and then scour it bright with emery cloth. Next apply raw spirit to the cleaned part, and coat it with solder by means of a copper bit, then flow the solder over the hole to render the bath sound. Holes in brass vessels are repaired similarly to the method described above, killed spirit instead of raw spirit being used for the soldering operation after the metal has been cleaned.

Salmon Fishing Rod.—For making a fishing rod for salmon, procure a piece of greenheart 3 ft. 9 in. long by ¾ in. square for the butt and a piece of walnut 1 ft. 6 in. long by 1½ in. square for the handle. For the middle part use a piece of greenheart 4 ft. 8 in. long by ¾ in. square, and for the top joint use a piece of greenheart 3 ft. 3 in. long by ½ in. square, and a piece of lancewood 2 ft. long by ¾ in. square. A set of 1½-in. winch fittings and a ⅝-in. and a ¾-in. ferrule with counters will also be required. Take the part to form the butt and place the ¾-in. ferrule at one end and give it a tap with a mallet to strike a circle, then at the other end with a pair of compasses strike a circle ⅛ in. in diameter. Plane up the wood square and straight between the two circles, then plane off the corners to form an octagon, and finally round off the edges with the smoothing plane, and rub off the plane marks with a file. Remove the file marks with a steel scraper or a piece of glass and finish with glasspapers of different degrees of fineness. With a ¾-in. bit bore a 5-in. hole into one end of the handle and taper the hole out with a wood veiner. Plane the end of the butt to fit the hole perfectly and glue it in. When the glue is dry, round up the handle with the plane and work the bottle neck with a spokeshave, finishing with a file and scraper as in rounding the butt. Now take the second part and strike circles with the ⅝-in. ferrule and ⅝-in. counter and round up as described for the butt. Next round up the pieces of greenheart and lancewood to form the top roughly, and taper the top end of the greenheart and bottom end of the lancewood to fit each other, forming a splice 4 in. long. Glue the pieces together at the splice and allow to dry, then bind up the joint with a piece of string. When the glue is thoroughly set, remove the string and round up to an even taper from ⅝ in. at the counter to $\frac{7}{16}$ in. at the point. Now fit on the ferrules and counters, easing down the wood carefully with a file until the ferrules and counters will drive on tightly with the mallet, fixing each one in position with a small rivet or by a blow on each side with the point of a centre-punch. The rod can then be

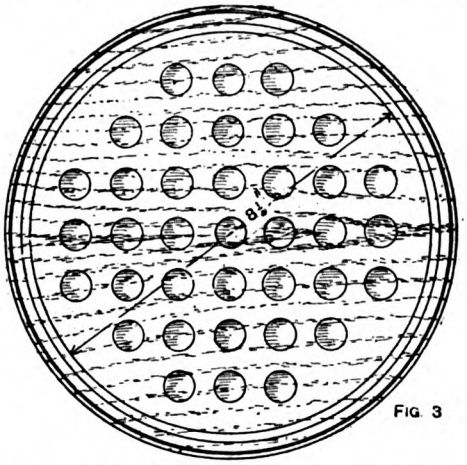


FIG. 3

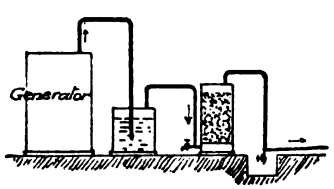
cleaned up with fine glasspaper and French polished. Now whip on a set of rings, using about four on the top, three on the middle, and two on the lower parts, placing them at proportionate distances apart. Whip on short lengths of binding below the ferrules and above the counters, also between the rings, whip on a suitable top ring, then give the bindings a couple of coats of shellac varnish, and when this is dry (the next day) give the rod a coat of copal varnish. The above lengths will make a rod about 14 ft. long, but the lengths may be modified to suit requirements.

Drains Choked by Grease.—One method of preventing a scullery drain-pipe from being choked by grease is to fix a grease-intercepting trap into which the greasy water may flow; such a trap, however, is found to be an abominable arrangement. The trap must not only be frequently cleaned out and the grease removed by hand, but the very objectionable smell that arises from the trap during the process of cleaning is most offensive, not only to the person who has to do the work, but to everyone who may be in the house or in the neighbourhood. A flush-out grease-trap is the best. To this trap is attached an automatic flushing cistern by which the cake of grease that forms on the surface of the water in the trap is broken up and driven through the drains in a solid or semi-solid state.

Removing Cider Stains from Linen.—If the stains on the linen are purely organic stains from the cider, make a solution of chloride of lime, and in this steep the stained portions of the linen for from fifteen to thirty minutes, followed by thorough washing in several changes of clean water without soap. If the stains also contain iron, steep in a solution made by mixing 1 part of strong acetic acid with 10 parts of water.

Clockwork to Drive Fan.—Below are particulars of a clockwork motor required to drive a fan 10 in. in diameter at a speed of about 400 revolutions a minute. A barrel drum 4 in. in diameter grooved for a line and weight, and fitted with a main wheel of seventy-two teeth, drives a pinion of twelve leaves mounted on an arbor with a wheel of seventy-two teeth. This drives another pinion of twelve leaves mounted on the same arbor as a band wheel 10 in. in diameter driving the first 2-in. pulley. The 9-in. band wheel mounted with it then drives the 2-in. pulley on the fan shaft. The train is thus:—1st, barrel for line, main wheel 72; 2nd, wheel 72, pinion 12; 3rd, band wheel 10 in., pinion 12; 4th, wheel 9 in., pulley 2 in.; and 5th, fan pulley 2 in. This will give about 800 revolutions of the fan to 1 of the driving barrel, and for 400 revolutions a minute the barrel must turn once in two minutes, and will thus take 6 in. of line for every minute of run. For a run of one hour, the motor will want 30-ft. drop for a single line, 15-ft. drop for a double line, or 10 ft. for a triple line. The weight must be determined by trial, but would probably be 40 lb. on a single line, 84 lb. on a double, or 180 lb. on a triple line.

Acetylene Generating Plant.—The accompanying illustration shows all the parts—generator, washer, and purifier—of a generating plant. The generator itself is shown on the left, and the gas coming away from the generator is shown passing to the washer. The latter is merely an iron vessel of any form, and about three-fourths full of water. The gas, as it comes over from the generator, escapes into the washer near the bottom about 3 in. to 6 in. below the water-line (according to the pressure developed in the generator), and then bubbles up and is cleansed of all impurities that are susceptible to water treatment. With many generators the washing arrangement is part of the apparatus, and not a separate vessel as here shown. The water in the washer must be changed once or twice a week. From the washer, the gas goes to the purifier (which also dries



Acetylene Generating Plant.

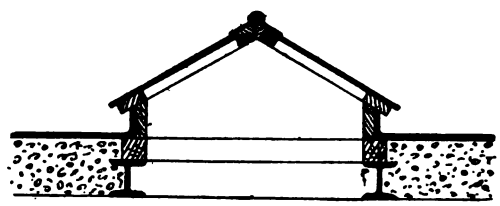
the gas). This appliance is used for the purpose of ridding the gas of two impurities that are not susceptible to water treatment. The commonest purifying material is chloride of lime (bleaching powder), which is mixed with a little ordinary unslaked lime. The lime is then put loosely in muslin bags, and laid on trays in a vessel, so that the gas must filter through the lime. A material now largely used for purification is Puratylene, which is composed of the same mixture of lime formed into porous lumps. No bags or trays are needed, but only a tall iron or zinc keg, in which a space is left at the top and bottom, as shown in the illustration. From the purifier, the gas goes to the house; but at the commencement of the house service (assuming that this is the lowest point) is a small cock, which is placed there for the purpose of discharging any condensed water that may collect at this lowest point of the service. The generator presumably includes a gas-holder; if not, the best position for the gas-holder is between the washer and the purifier.

Chrome Red.—Chrome red, a pigment also known commercially as Derby red, mock vermilion, and Persian red, is a basic chromate of lead made in a variety of shades from pale orange to deep scarlet red. The following is the method of manufacture on a large scale. For orange chrome, take 252 lb. of lead acetate or nitrate, 88 lb. of bichromate of potash or soda, and 23 lb. of sodium hydrate or caustic soda (77 per cent.). The bichromate and caustic soda are dissolved separately in large lead-lined vats. The lead acetate is also dissolved in a large precipitating tank which has large revolving wood paddles driven by steam power. The greater the volume of water the finer the results. The bichromate solution is then run steadily into the precipitating tank on the lead solution whilst being agitated with the paddles, the result being the formation of yellow chromate of lead (chrome yellow), which rapidly precipitates. The clear water is then run or syphoned off, and the caustic solution run into the yellow. The mixture is now boiled by means of a steam jet and thoroughly agitated until the desired depth of colour is obtained; the mixture is then allowed to cool down and settle, the top water is run off, and the colour is washed repeatedly with cold water and again allowed to settle, when it is strained upon filter cloths, pressed and dried ready for use. Chrome reds may be modified somewhat by altering the proportions of the bichromate and alkali and the time of boiling. The larger the quantity of alkali added the deeper the resulting red, as may be observed by the following table.

Ingredients.	*Orange.*	*Scarlet.*	*Deep.*
Lead acetate or nitrate	11	11	20
Bichromate of potash or soda ...	¼	¼	10
Caustic soda or sodium hydrate	1	1½	3

The essential feature in the preparation of chrome reds is the finish or washing of the colour after boiling; all traces of alkaline matter should be carefully removed by washing, otherwise the durability of the pigment will be affected. Chrome reds are good bodied pigments of exceptional covering power and brilliancy, and are durable under ordinary circumstances. But when submitted to sulphurous gases they turn black owing to black sulphide of lead being formed. They should not be compounded with pigments containing sulphur, such as ultramarine, oxides, and cadmium yellow, which have an effect similar to that of sulphurous gases. The purity of chrome reds may easily be determined, as pure reds are completely soluble by boiling in strong hydrochloric acid, any residue being the adulterant.

Concrete Roof with Skylight.—The accompanying illustration shows construction of a concrete roof containing a skylight. The main difficulty is to keep the roof "drop-dry," and the only really efficient method is to cover the concrete with a ¾-in. layer of asphalt (the best



Constructing Concrete Roof with Skylight.

that can be purchased) turned up all round the frame of the skylight. Detailed description need not here be given of the remainder of the materials and method of construction, as the drawing herewith is self-explanatory.

Copal Varnish.—Copal varnish derives its name from the gum copal, a hard lustrous gum found principally on the West Coast of Africa, in the Sierra Leone district. Gum copal is a fossil gum, and is found at varying depths in the soil, from which the gum is dug out by the natives; traders buy the gum and export it to various countries for the preparation of varnish. The best hard copal varnishes (the hardest, most lustrous, and most durable varnishes) are prepared from West Africa copal gum; by careful selection of the gum very pale varnishes that are suitable for all classes of decoration, both interior and exterior, coach painting, sign and carriage decoration and painting, can be produced. Copal varnishes are prepared by fusing the gum and afterwards adding clarified linseed oil and turpentine; driers, such as litharge, acetate of lead, and manganese, are also added. Varnish is tested for paleness by placing, in a thin glass vial, a small quantity of varnish and comparing it with any standard sample by holding both samples up to the light. In order to test the varnish for wear and durability, apply two coats of varnish to two pieces of newly planed wood, which should be perfectly dry and be carefully glasspapered; one piece of wood should be coated with the standard sample, and the other piece with the varnish that is to be tested. Place both pieces of wood in an exposed exterior situation, and note from time to time the appearance of the work; that piece which loses its brilliance and cracks in the shortest time has been coated with the inferior varnish. Another simple test is to re-varnish any suitable surface with the suspected sample, and when the varnish is thoroughly dry, rub it briskly with the finger; if the new varnish crumbles up quickly, it evidently contains an inferior gum or most probably a large proportion of resin. A good copal varnish cannot be removed in this way unless, of course, exceptionally hard friction is employed.

Chemical Fire Extinguisher.—When the sulphuric acid from the bottle in a fire extinguisher is brought into contact, by breakage, with the surrounding alkaline water, the acid immediately acts upon the carbonate of soda, liberating carbonic acid, and forming sulphate of soda. With carbonate of soda, the following reaction occurs:—

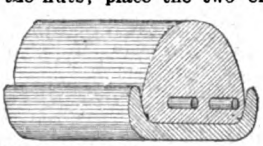
Na_2CO_3	+	H_2SO_4	=	Na_2SO_4	+	CO_2	+	H_2O.
Carbonate of Soda		*Sulphuric Acid*		*Sodium Sulphate*		*Carbonic Acid*		*Water.*

But with bicarbonate of soda, one equivalent of sulphuric acid produces double the quantity of carbonic acid; thus:

$2NaHCO_3$	+	H_2SO_4	=	Na_2SO_4	+	$2\,CO_2$	+	$2\,H_2O$.
Sodium Bicarbonate		*Sulphuric Acid*		*Sodium Sulphate*		*Carbonic Acid*		*Water.*

Carbonic acid is a gas at ordinary temperature, and is only held in solution in the water in the cylinder by great pressure; as soon as the valve is open, carbonic acid escapes, and forces the water out in a continuous stream till the cylinder is empty, and the pressure is relieved. The water contains both sulphate of soda and carbonic acid, and is very much better than ordinary water for putting out a fire, carbonic acid especially being a non-supporter of combustion. No other acids are used, simply because sulphuric acid is the cheapest acid, and weight for weight is more powerful than any other commercial acid. Hydrochloric acid could be used, but would not be found so economical as sulphuric acid.

Putting Rubber Tyres on Carriage Wheels.—In putting rubber tyres on carriage wheels, the rubber at the joint is not spliced, but it is simply butted together. Measure round the wheel to determine the length of rubber required, but cut off a few inches longer so as to be on the safe side; it can easily be cut off to the right length when the wheel is finished. For putting on rubber tyres a wired-on tyre is best; it requires neither cement nor a machine for fixing on the wheel. The illustration shows a section of a wired-on tyre. To put the tyre on, take two wires and screw the ends to suit the nuts; place the two ends level and

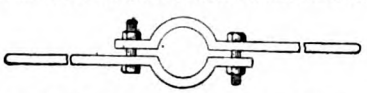


Section of Wired-on Tyre for Carriage Wheel.

fasten up in the vice; then, with a tape or wax-line, measure round the wheel; allow ¾ in. more than the circumference, and mark off the two wires to the length obtained (not cut off). Now cut off the rubber, and, as it has to be cut off so much longer to allow for compression, the rule is as follows. After getting the circumference of the wheel, allow 1½ in. for every foot in length. Thread the wires through the rubber, and when the screwed ends are projecting about 3 in., fasten a small clamp on each wire to prevent them slipping back. Now take the wires at the other end of the rubber, fasten them in the vice, and pull the rubber well back until the end is beyond the marks that were made at the commencement. Fix two small cramps to keep the rubber in position, cut off at the marks, and screw the ends to fit the nuts. Now circle the tyre, place the screwed ends of the wire together, and fasten them by the nuts; when screwed up tight, take off the clamps and let the rubber come together; put the rubber on the wheel as far as possible, and hold in position by clips. To get into the channel the remainder of the tyre, work it over with a lever, gradually working all round and hammering down with a rubber mallet until the rubber is in position.

Finishing Cases of American Pianos.—High-grade American pianos are mostly of massive build, and are finished in a manner very different from that usual on English goods. The latter are of French-polish finish, whilst the Americans build up the surface with varnish; and in this matter it is interesting to note that the varnisher has high-grade goods on his hands for nearly three months, varnishing and drying, re-varnishing and re-drying, till a surface is built up that will stand scouring with pumice powder, each application of varnish being allowed to stand several days before the next is applied. The operations of varnishing, drying, and smoothing down are carried on in order until a perfect gloss is gained and the grain of the wood reflects all its beauty. It is also interesting to note that even on some expensive instruments choice veneers are seldom used, the finishers being thoroughly expert at closely imitating Nature's handiwork. The figure is gained for the most part by mechanical means, such as soft leather graining rollers, thus ensuring greater uniformity of figure and colour. Each part of a piano is thus varnished at least six times and placed in a warm drying-room, the surface each time being smoothed and dulled down, till the last or "flowing" coat is applied, for which purpose the finest badger-hair brushes are used. This gives a level, bright finish somewhat similar to that seen on best carriage work. Toning down is effected by rubbing with finest possible grade pumice powder and rottenstone, finishing off with the workman's bare hand, which imparts a better finish than cloth. Finally the lustre is brought to a high degree of perfection by rubbing with piano oil cleared out with alcohol. The composition of the varnish differs very much from that used by French polishers, being very elastic, yet tough enough to withstand the grinding-down process; consequently, the varnish cannot be satisfactorily made on a small scale. Another characteristic of American instruments is the frequency with which one meets dull panels, which considerably enhance the beauty of the bright portions. Unfortunately, in large towns with sulphur-laden atmospheres, these varnish-finish goods soon bloom or acquire a smoky appearance unless often rubbed up; and as constant rubbing by dry dusters eventually produces a scratched appearance, the better plan is to freshen up occasionally with piano oil. For this, mix sweet oil and turpentine in equal parts; but before using it, every particle of dust or dirt should be removed. A lump of common washing soda the size of a walnut should be dissolved in 2 qt. of rainwater, and the case washed down with this, using a soft chamois leather. Rub on a little of the piano oil, using wadding, and wipe off with soft rag, and then wipe with another piece of soft rag or old silk handkerchief with a few drops of alcohol sprinkled on its face, and well pressed in. Vapour up to a fine polish by applying very lightly at first, and working always in a straight direction.

Removing Fired Box of Axle Arm.—To remove from an axle arm a box that has fired, take the other wheel off the axle and then remove the axle from the carriage. It is necessary to unscrew the front cap of the box that has fired, and to stand the axle on its end and fill up the front end of the box with oil. Then screw on the cap to prevent the oil running out, hold the box over a fire and



Wrench for Removing Fired Box of Axle Arm.

heat it until it can be barely touched without burning the hand. Fix the axle end upwards in a strong vice, fasten a wrench as in the illustration on the box and try to turn it round on the axle arm. If it will not move, mix some paraffin with the other oil and repeat the process. When the box moves on the arm, fix the axle horizontal in the vice, and whilst turning the box round get an assistant to give some blows on the back of the box, using for this purpose a piece of hard wood and a small sledge hammer, and so drive the box off the arm. If it will not come off with this treatment, then the only remedy is to smash the box, and, if the arm is not cut too badly, have a fresh box fitted on. The wrench mentioned should be fixed on the box so that the webs are close to the bolts.

Door Knocker Electric Bell Push.—A novelty in electric bell push design is one in which the knocker and bell work simultaneously. The device can be easily made by connecting the bolts at top and bottom, which come through the door from the knocker and pad, separately to the bell wires. If the handle happens to be connected with the pad through a metallic base, the latter will have to be drilled through and a metal pad inserted and insulated from the base by a wooden or vulcanite washer, but connected on the inside with the lower wire. A small spring will be required under the upper portion of the handle to keep it off the pad when not in use. The circuit then will be completed only when the knocker strikes.

Finishing Boot Waists.—There is no practicable method of finishing the soles of the insteps of boots with a bright-finished black that may be applied with a brush and will dry quickly. The quickest method is by a power-driven burnisher, and the next in speed is hand burnishing. This is after the burnishing ink has been applied and allowed to get all but dry. Hold the toe between the knees with the heel against the chest quite firm, and press hard while rubbing up and down with a two-handled burnisher. Then put on a little fake, made by melting hard heelball and a little white glazing ball in mineral naphtha, in a slow heat away from any flame, and when nearly dry polish off with a dry, soft cloth.

Simple Churn.—The household churn illustrated by Fig. 1 will make ¼lb. of butter at a time, taking for the operation ten minutes. In cold weather the time is slightly longer, but if the cream is warmed, slightly less. It has stood the test of experience in all weathers and climates. The container is an ordinary preserved-plum jar about 6½ in. by 3¾ in.; of course, any vessel of similar size may be used, and earthenware or tin might be employed, but a glass bottle is much the best, as the process may be watched. The bottom portion of the dasher (below the collar) should be grooved out to fit the dasher blades, ¼ in. deep; the grooves should be a fit with the dasher blades, so that when wetted and swelled they are fixed tight. When the dasher is ready, slip the container cover on from the bottom (the hole in the cover is ¼ in.), slide the dasher blades into their grooves, and drop the whole into water for an hour, when the blades will be found quite tight. The base A is 1ft. long, 6½ in. wide, and 1in. thick, with a ¾-in. projecting ring 3⅜ in. internal diameter (see Fig. 2). The top fastener B (Fig. 1) and cover fastener C (see Figs. 3 and 4) are ¾ in. thick. The standards D (Fig. 1) are 1in. in diameter and 1ft. long, exclusive of 1-in. ends ¾ in. in diameter, with a hole in the centre of each for pins E, and others in ¾-in. ends for the pins F. These pins are made from No. 16 B.W.G. brass-wire, 3in. long, exclusive of the head. Fig. 5 shows a plan and section of the container cover. It is 1in. thick and 5in. in outer diameter, with a ¼-in. groove, ¼ in. from the edge, and a central ¾-in. hole. The dasher has three blades, 1¼in. wide, 4in. maximum and 3in. minimum length, and ¼-in. holes. Fig. 6 shows the shape of one of the blades. The centre spindle is 1in. in diameter at the top, with a ⅜-in. pin 1in. long, the diameter of the spindle being reduced to ¾ in. for the blades. The collar G (Fig. 1) is 1in. thick and 1½ in. in diameter. To use the machine, slip the container into the bottom ring (see Fig. 2), fill it three-quarters full with cream, put in the dasher, fix the cover on the bottle, slide the cover fastener on from the top, and fix it hard down on the cover by the two pins, which should fit tight into the holes in the standard just level with the top of the cover. Now slide on the top fastener and fix it similarly with two pins, fasten the churn by a cramp to a table top, take half a dozen turns with string round the dasher stem above the collar, and pull it sharply to and fro. To prevent losing the pins, they should be fastened to the standards by small staples and strings. When not in use, always keep the container full of clean water, with the dasher in position. The woodwork should be made of teak, which will stand the wetting and drying, and does not taint the butter.

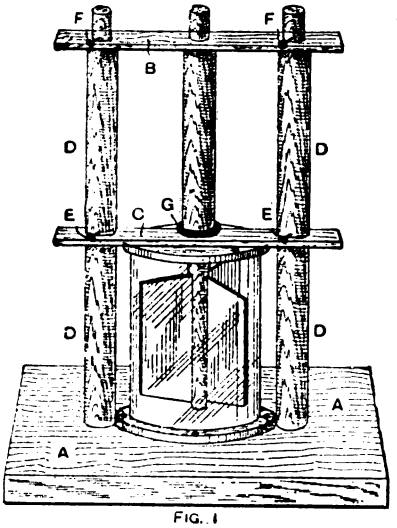


FIG. 1

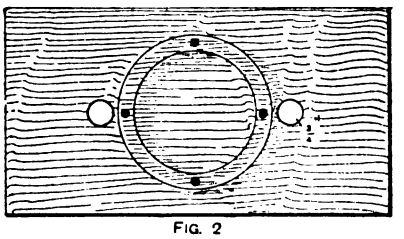


FIG. 2

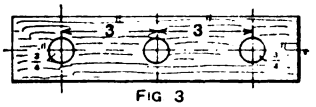


FIG 3

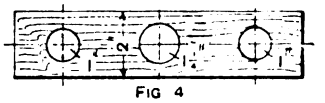


FIG 4

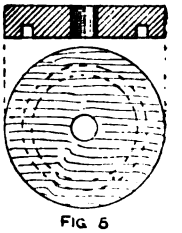


FIG. 5

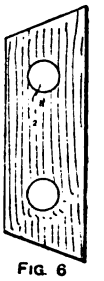


FIG. 6

Simple Churn.

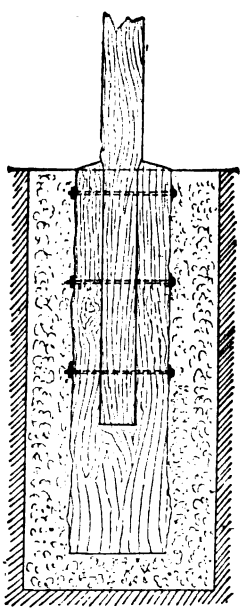
Proportionate Exposures for Photographic Prints on Bromide Paper.—The statement that the "intensity of light varies inversely as the square of the distance" indicates the proportionate intensities of light at different distances, and the exposures will be in direct proportion to these intensities, all other factors remaining constant. In the next column of this page appears a reliable table showing the exposure needed at any distance, provided the exposure at some other distance is known. The figures in the top line may be taken either as inches or as feet, according to the distances likely to be used; the latter, however, is not usual. The second line shows the proportions at these distances. The lines below show the exposure at any other greater distance when the exposure is one second at any point. Multiples of these may, of course, be used if desired.

Actual distance.	1	2	3	4	5	6	7	8	9	10	11	12
Proportionate intensity.	1	4	9	16	25	36	49	64	81	100	121	144
Proportionate exposures from one second at either distance.	1	2¼	4	6¼	9	12¼	16	20¼	25	30¼	36	
		1	1 7/9	2¼	4	5¼	7⅛	9	11¼	13¼	16	
			1	1 7/9	2¼	3 1/9	4	5 1/9	6¼	7 2/9	9	
				1	1¼	2	2¼	3 1/9	4	5	6	
					1	1¼	1½	2¼	2½	3¼	4	
						1	1¼	1¾	2 2/9	2¾	3	
							1	1¼	1 2/9	1½	2	2¼
								1	1¼	1¼	1½	1¾
									1	1 1/9	1 1/12	1 1/9

Vermilionette and Vermilion.—Vermilionette (also known as mock vermilion, signal red, and royal red) is prepared from aniline dyes, eosine being the principal agent. The shades of colour in general use vary from a pale pink to a deep scarlet. These colours are struck or tinted on barytes and orange lead in variable proportions, the precipitating agent being lead acetate or nitrate, the depth of colour depending on the quantity of eosine that has been used. Some makers use aluminium sulphate, instead of lead acetate or nitrate, but the resulting colours are less permanent and less brilliant. Vermilionettes are much used by coach painters for the stringing or lining of vehicles; but these colours are not recommended in cases where permanency is required, as the tints fade after a few months' exposure, especially when subjected to strong light such as the sun's rays. The durability of these colours may, however, be somewhat lengthened by coating them with a hard drying varnish. Vermilionettes are in no respect comparable as regards permanency with pure vermilion; vermilionettes may be easily distinguished from vermilion by mixing a small quantity of the suspected colour with water, and rubbing the mixture on the finger-nail; should any stain be left on the nail after the colour has been removed, the paint is vermilionette. Heat also destroys vermilionette, and when mixed with water, it exhibits a peculiar fluorescence; this fluorescence is also noticeable in the water that is placed in the package in which the paint is stored as an oil paint in paste form. All these tests for determining the adulteration of vermilion with vermilionettes are simple and accurate. Madder reds, which are less costly than vermilion, are now finding favour among coach painters and decorators, owing to the brilliancy, permanent shades, and density of colour of these reds. The pigments are prepared in a variety of shades, some of which resemble vermilion in appearance, and possess even greater covering powers. Many of the large railway companies and fire brigades are adopting these colours in preference to vermilion. Other notes on vermilion, its use and its liability to darken, are given in Series II., p. 228.

Ignition for Bicycle Petrol Motors.—Ignition by incandescent tube on a bicycle petrol motor is out of the question. The drawbacks of tube ignition are numerous, two prominent faults being inability to keep the tube at the proper heat, largely due to the excessive vibration; and misfiring, due to the high speed (about 2,000 revolutions a minute) at which these motors have to run to develop their power. Electric ignition is therefore imperative. There are two electric ignition systems; one with coil and accumulator or battery, the other being magneto ignition. The magneto system is undoubtedly the better, there being no wires to short-circuit, and no coil or accumulator being needed, therefore there are no troubles about charging accumulators, etc. There may be a few more wearing parts, but three-fourths the troubles usual to the coil ignition are swept away by using magneto ignition. This ignition cannot be adapted to any existing cycle motor; this is the reason the coil ignition is at present so largely employed, as it can be used with any type of motor, whereas magneto machine and motor have to be built together by the manufacturer.

Fixing High Flagstaff.—A method of fixing a high flagstaff is explained below. The depth and diameter of the hole will vary with the nature of the soil. Get the trunk of a young elm tree about 1 ft. 6 in. in diameter, and a few inches longer than the hole is deep when the bottom layer of concrete has been put in, and make two saw-cuts down the middle, about 4 ft. long, and say 2 in. less apart than the diameter of the flagstaff. The middle

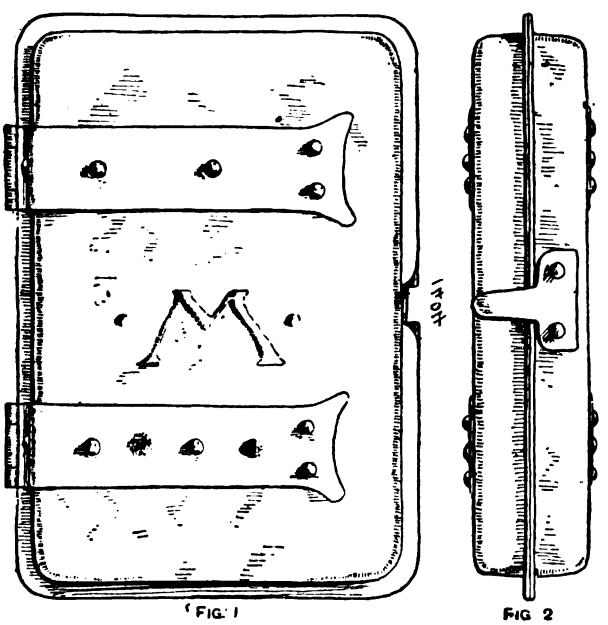


Fixing High Flagstaff.

piece will then have to be cut out, and the best way to do this is by means of a red-hot wire. Then axe or saw the bottom end of the flagstaff down to fit tight in the trunk, and secure it in place by three bolts as shown in the accompanying illustration, placing washers under the heads and the nuts. The bottom end of the trunk should be cut level, so as to sit flat on the concrete, and the top end should be bevelled towards the outside to let the rain run off.

Repolishing Prisms.—A Nichol prism is finally polished on dry paper, which is less liable to round the edges than cloth or silk. Stick cartridge paper on a flat surface plate, or on a flat chuck which may be revolved on a lathe. Mix together a teaspoonful of starch and a little cold water to a consistency rather thicker than that of cream; on this pour boiling water, and stir quickly; then rub a little over the centre of either surface, lay the paper on, and press down with another flat surface. When dry, rub a little rouge on with a piece of tissue paper, rubbing as much off as possible. Then proceed to polish. Give five or six rubs from left to right in a circular direction, and then five or six from right to left. It is most important to keep changing the direction of the sweep. If the tool is not stationary but revolving in the lathe, it should be revolved as slowly as possible, and the polishing done by means of tripoli. If the prism is very badly scratched and defaced, it should be ground up with fine emery on a special tool. But this should not be attempted by an unskilful operator, unless the prism is of little value, because it is almost sure to have its shape altered, and be spoilt.

Cigarette Case.—The cigarette case shown by Figs. 1 and 2 is intended to be worked in copper, about No. 21 or No. 22 B.W.G. The edges of the two halves are hammered up first, the projecting rims being put on afterwards. A good effect is obtained on the surface of the copper by hammering it well with the ball pene of a small hammer before raising the edges. The metal must be constantly annealed during the latter process, and if the hammering is done slowly and carefully no great difficulty will be found. Each rim must be cut out in one piece, trimmed to fit flush with the inside of the hammered edge, and then neatly soldered or brazed on. The hinges can be obtained from the pieces cut out in making these rims. They should be made as fine as possible with straps as shown in Fig. 1, and a piece of steel piano wire makes good pins for them. The straps of the hinges are held by brass wire rivets worked up to a head on the outside (see Fig. 2) and countersunk inside. Where the hinges go, the projecting rim is cut away. The catch fastening the case can be made so that the tongue snaps over a small stop, or the tongue may simply hold the two halves together by friction. It should be



Cigarette Case.

riveted on in either case. To keep the cigarettes in place, small steel eyes made from wire are soldered inside each half and a piece of round cotton-covered elastic is stretched across with a knot at each end. The case can be lined with thin black leather or may be left quite plain, as preferred. For cleaning the metal after the case is finished, an old tooth-brush and some scouring soap will be found effective, as by this means every corner can be reached. The initial of the owner's name can be embossed on one side of the case, and should be done on a pitch block in the ordinary way before the rims are fastened on. Suitable measurements for a case to hold twelve ordinary cigarettes are 2¾ in. by 1⅛ in. by ⅜ in. inside.

"Slap Bangs."—By "slap bangs" is meant the small packets which explode when thrown violently on the pavement. These may be made by mixing carefully with the hands 1 part of powdered sulphur or flowers of sulphur with 4 parts of chlorate of potash. About half a teaspoonful of this mixture is placed in each tissue paper and screwed up. A finer "bang" is produced with a few grains of fulminate of silver, but this is much more expensive.

Putting on the Chain of a Lever Watch.—Here are hints as to the manner in which the chain is put on an English lever watch. Put in all the train wheels, etc., including the third wheel. Turn the fusee round until the fastening for the chain hook is against the edge of the movement. Turn the barrel round until the hook hole is outside. Hold the movement in a vertical position with the fusee uppermost, and drop the chain (the barrel hook being first) through the place the chain must occupy; then hook the barrel hook in the barrel, and, placing a key upon the barrel arbor square, wind the chain upon the barrel, guiding the chain with the finger tip of the hand that holds the movement, and hook the fusee end into the fusee. Place the barrel ratchet on, and "set up" the mainspring about half a turn; the chain will then be tight, and all wound upon the barrel except about a quarter turn on the fusee. Now place a key on the fusee square and wind the watch up; this transfers the chain from the barrel to the fusee. See, while winding, that the chain does not drag sideways, or it will be pulled out of the fusee grooves.

Converting Cycle Petrol Motor into Free Engine.—Below are hints, accompanied by diagrams, on fitting the driving wheel of a motor bicycle to the shaft of a motor in such a manner that it could be thrown out of gear when desired, which would be of great advantage when coasting. If the motor is not built with a free engine clutch, the only means of converting it into a free engine is to use a jockey attachment (shown in plan and elevation at Figs. 1 and 2), which must operate on the driving belt between the engine pulley and

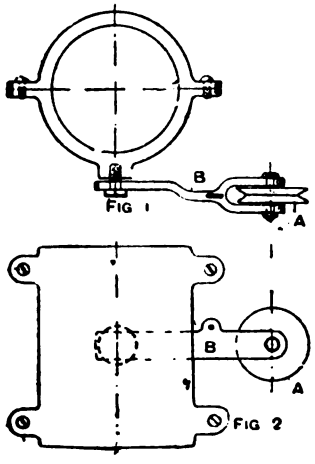


FIG 1 FIG 2

Converting Cycle Motor into Free Engine.

driving rim on the wheel. But the use of a jockey pulley is not recommended at all, as it has the following disadvantages. (*a*) Reduction of horse-power of motor; (*b*) wear of engine pulley and belt when the belt is slack and the engine is running free. The jockey attachment is operated either by raising or depressing the jockey wheel A by means of a rod attached to B. By this means the belt can be either tightened or slackened. When the belt is slack the engine is free, and when the belt is tight the engine is in gear. By far the best method for coasting, etc., is to use an exhaust valve lifter; this releases the compression, cools the cylinder by drawing cold air into it, and prevents waste of petrol through the inlet valve. Exhaust lifters are generally operated by a Bowden wire.

Mechanical Pianoforte Players.—The main features of mechanical piano players are alike, but they vary in details. There are main bellows and small bellows, one for each note. The pianista music folds up like a book; in the pianola and most up-to-date mechanical players the music sheets are on revolving rollers. The mechanical principle of the pianola is pneumatic. As the operator works the foot pedals, the music sheet on one roller is unwound and winds itself over another roller. In its passage the music sheet travels over a cavity box with small apertures, one to each note, the air passes through the perforations in the music sheet which represent notes, and thus the air releases the corresponding pallet. A set of small sensitive bellows operates the pallets thus released, this in turn operating the striking finger situated immediately over the piano key. There is one small bellows for each note, the object of these bellows being primarily to transmit power rather than to emit a tone or note. Some instruments are furnished with reeds as an accompaniment to the notes given by the piano. These reeds should always be in unison, the piano being tuned to the attachment, and they can be played at the discretion of the operator, the connection being made by simply drawing out a stop knob, which thus connects an extra set of pallets, these working simultaneously with those which operate the piano keys. The striking movement can be gained either by a lever affixed to each small bellows, or by plungers (round rods) similar to those used in American organs.

Field-gate Construction.—The ordinary field gate, as a rule, is put together in the rough. The rails (shivers) are not tenoned, and the mortises are so marked off and made in the hanging and swinging stiles that the rails, when inserted, show them to be spaced as in Fig. 1. It will be noticed that the gate is so hung to the hanging post H that the swinging stile beats against the beating post P. The top and bottom mortises in the hanging stile go right through, but the other three mortises go only about halfway in the stile, this being the stronger method. All the mortises in the swinging stile go through. The hanging stile is placed flat on the bench against a stop. The rails are now driven with a heavy hammer snugly into the mortises, the top and bottom rails being wedged as at W and pinned as shown. The swinging stile is next driven on and each rail is wedged, and the top and bottom rails are pinned, the rail ends and wedges being then sawn off fair with the stile. The long brace B (Fig. 1) is now placed in position and lined off on the hanging stile. Two saw-kerfs are made in the lines, and the part between them is removed with a mallet and chisel to a depth sufficient to allow the brace to lie flat on the rails. The short brace is shoed against the hanging stile, and both of the braces are

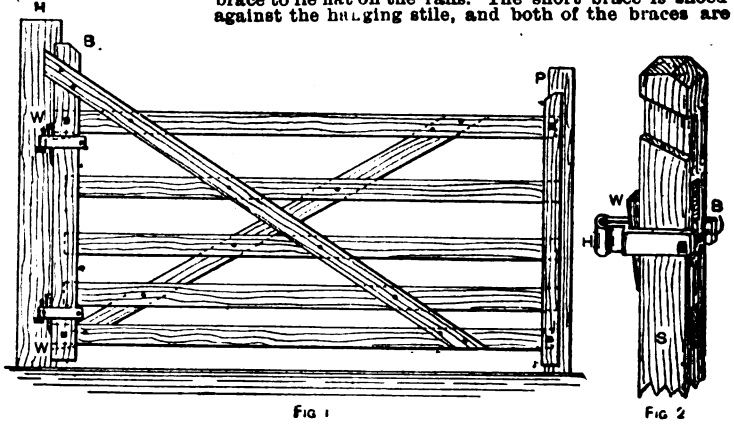


FIG 1 FIG 2

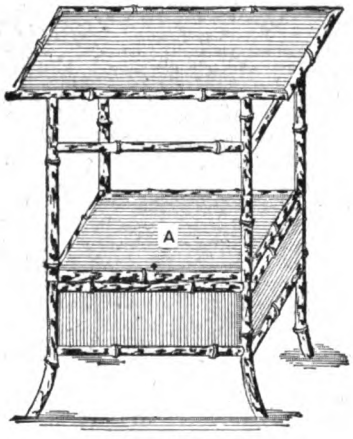
Field Gate Construction.

nailed to the rails with 2½-in. rosehead nails, and clinched. In some cases small bolts are used to secure the braces. Fig. 2 illustrates a method of securing the hanging H to the stile S. The hanging is slipped over the stile, and the bolt B passed through holes in the hanging, and secured with a nut, a hardwood wedge being driven in at W. The usual length of this gate is from 7 ft. 6 in. to 8 ft. The hanging stile is 4 in. or 4½ in. by 3 in., the swinging stile 2½ in. by 3 in., the rails are 4 in. by 1½ in., and the heights of the hanging and swinging stiles are 5 ft. and 4 ft. 3 in. respectively.

Altering Hairspring of Geneva Watch.—Before altering the hairspring of a watch as a remedy for losing or gaining, make sure that the defect is not caused by some other fault. Hands that are too easy, or that touch the dial or the glass, make a watch lose. Or a sticky hairspring, or one that is cramped up and touches something it should not, will make a watch gain. If none of these faults exists, to make the watch go slower the hairspring must be unpinned, let out a little, and re-pinned again. To make the watch go faster, the spring must be taken up a little shorter. After either operation the watch will be out of beat, and must be set in beat by turning the hairspring collet round on the balance, by inserting in the slit in the collet the thin blade of an oiler, and using it as a lever. To effect any of these alterations, the balance cock must be removed. But before removing the balance cock the watch train must be stopped by wedging the third or fourth wheel. Alterations of the hairspring require great care and much skill and practice, and a novice who does not know how to remove a balance cock is advised not to touch a hairspring.

Formalin as Disinfectant.—The disinfectant formalin (formaldehyde, CH_2O, in aqueous solution) coagulates all albuminous matters, and it therefore destroys bacteria by chemical action; and also, by similar action, coagulates any material on which bacteria would grow. Formalin is also a very volatile substance, and penetrates every corner of a room. The disadvantages of formalin are that it is very pungent, rapidly attacking the mucous membrane, and hence cannot be breathed with impunity. Formalin is sold in solution in water, at a strength of 40 per cent. A room may be disinfected either by spraying from without or by placing several saucers filled with formalin in various parts of the room. The room should be closed up until the formalin has passed away.

Bamboo Worktable.—The frame of a worktable of 1¼-in. bamboo should be dowelled up in the ordinary way as when making a best two-shelf table, except that the four second rails are lowered to within 5 in. of the bottom ones. A wood top is made of ½-in. board, 2 ft. by 1 ft. 4 in., and the stand is made in proportion, the legs being 2 ft. 3 in. long and the rails 18 in. and 11 in. long. A wood bottom, also of ½-in. board, is fitted for the box and secured with 2-in. panel pins. The four panels which form the sides are of Japanese best lacquer, and are secured similarly. A frame of 1-in. bamboo is made for the lid A and mitred at the corners, and a lacquer panel



Bamboo Worktable.

is fitted in and fixed. It is then swung on two strong nails at the two back corners, and a wood stop keeps it from going in too far. Another way to make the lid is to fit the panel without the frame, and hinge it on to the back long rail with brass butt hinges. The wood top is nailed to the legs, and three lacquer panels are fitted, the front being left open for the drawer-way. The drawer is made of ⅜-in. baywood, dovetailed, and a lacquer face is fixed on the front. Bearers are put in for the drawer, and a lacquer panel 2 ft. by 1 ft. 4 in. is fixed on the wood top. The drawer front, box lid, and the seven panels are all beaded with black cane, and a hooping of 1-in. split bamboo is worked round the top. The box and inside of the lid may be lined with Japanese leather paper, velvet, or quilted satin. Fix brass drop handles on the drawer and a small knob on the box lid. Varnish the table with brown hard spirit varnish.

Liquid Grain Filler for French Polishers.—Primarily, the object of a grain filler is to fill up the pores of the wood, thus giving a solid foundation on which the lac solution or polish is laid. The more solid this foundation the less will the wood absorb the liquid polish. Generally paste or putty fillers best fulfil this purpose; but on cheap work a liquid filler is occasionally used, simply because it requires the least amount of labour in its application. Low-grade resin varnish has also been tried, and is spread over the surface like paint, one or more applications being given; when dry, it is scraped off the surface by a cabinet-maker's steel scraper, under which the surplus resin flies off like dust. This leaves the pores or grain filled up with resin only. A tougher liquid filling closely resembling japanner's gold-size is made as follows. Linseed oil, 1 gal.; shellac, 12 oz.; litharge, burnt umber, red-lead, 8 oz. of each; and sugar of lead, 6 oz. Boil for four hours, or till everything is dissolved, remove from the stove, and gradually add 1 gal. of turpentine which has been previously warmed. The japan is used either alone or mixed with whiting, plaster-of-Paris, cornflour, starch, and colour pigments, and forms the binder of most of the American paste grain fillers.

Bodying-up in French Polishing.—Bodying-up is the stage of French-polishing known as building up the surface of lac. This, on best work, is done by means of rubbers only, but on cheap work the process is hastened by the application of one or more coats of varnish, which should be a spirit varnish of shellac basis. On some goods a foundation is built up of grain filler, polish, or spirit varnish, and finished off exactly as a painter or decorator finishes off grained and best work, that is, by applying copal, hard oak, church oak, or carriage varnish. These varnishes are applied by means of painter's hog-hair brushes, whereas spirit varnishes are best laid on by camel-hair brushes.

Buckets on Pelton Water Wheel.—On a Pelton water wheel the space between the buckets depends on their size and the quantity of water available. Fig. 1 shows method of spacing, the dotted lines A and B being centre line of the jets. The bucket C should be just commencing to take the water when the centre of the jet is striking the centre of bucket D. The second dotted line B shows a portion of the centre of a second jet if two jets are arranged for. Fig. 2 shows the face of an improved method of fixing the buckets. E is the edge of the wheel

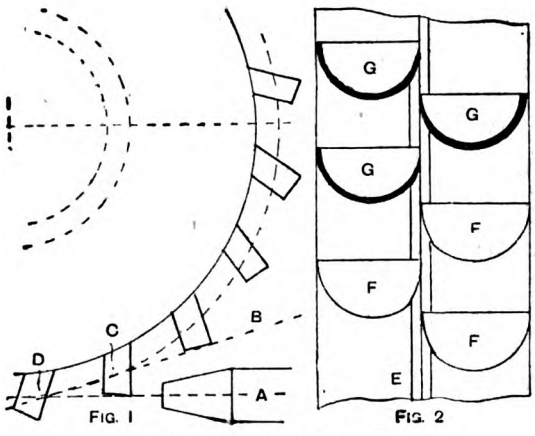


FIG. 1 FIG. 2

Buckets on Pelton Water Wheel.

brought to a sharp point; on the side are fixed the single buckets F and G in alternate positions, the buckets on each side of the continuous dividing edge catching the water alternately, thus securing a steadier motion. With this improvement an efficiency of 80 per cent. has been attained. The impulses are divided more regularly on the wheel, as each bucket passes the point of the nozzle and catches its portion of the water. In this type of wheel several jets may be used. The buckets F are shown in elevation, and the buckets G in section.

Repolishing Telescope Lenses.—Badly scratched telescope lenses should be replaced, as repolishing is expensive. But if the lenses are small and inexpensive, and not very badly defaced, proceed as follows. Get a boxwood chuck and some barrel pitch. Heat the latter over a spirit flame, and with it attach the lens to the chuck. The lens should be placed centrally on the chuck, and revolve quite truly in the lathe. It may be necessary to heat the lens gently with the spirit flame before it is successfully mounted. Now get another block of wood and turn it flat on the face, and slightly larger than the lens to be polished. Affix to the block, as already described, a layer of pitch about ¼ in. thick, by heating it to the consistency of dough and working it with the finger. The lens being cool on its chuck, cover it with a fine spray of saliva, and press it circularly into the pitch of the tool. The pitch, being warm, will take the shape of the lens, and the saliva will prevent it sticking. With this tool the lens may be polished, using fine putty powder moistened with water, the lens being slowly and regularly revolved in the lathe, and the polisher being with a slightly quicker motion revolved in an opposite direction. Deep scratches cannot be obliterated by this method, but if there is only a little cloudiness over the surface of the lens, this is soon removed. There is always a risk of an unskilful operator ruining the lens by incorrectly manipulating the tool.

Cleaning Upholstered Furniture.—An excellent cleaner for furniture serges, tapestries, moquettes, and carriage cloths is spirit of wine 2 parts and ammonia 1 part, to be rubbed in rigorously with a swab of soft rags. For saddlebags and woollen velvets, after beating the material, wipe over with water and oxgall in the proportion of one oxgall to a pail of water: this will revive the colours wonderfully. Silk velvets, plushes, satin brocades, and silk tapestries cannot be successfully cleaned without being taken off the furniture. Wiping over with a swab moistened with benzine will revive the materials to some extent, but great care is needed not to overdo it. Surface stains can be removed by gently rubbing with one of the soft putty rubbers sold by stationers, or with fuller's-earth made into a thick paste and allowed to dry thoroughly on the fabric, and then brushed off. Hair seating can be cleaned with paraffin and then rubbed over with black ink.

Goat Chaise.—If the goat chaise (Figs. 1 and 2) is to be painted, construct it of whitewood, but walnut or birch, with ash mouldings, looks well if finished in the natural wood. For the body, get two pieces of wood 1 ft. long, 2 in. wide, by 1 in. deep; plane them square

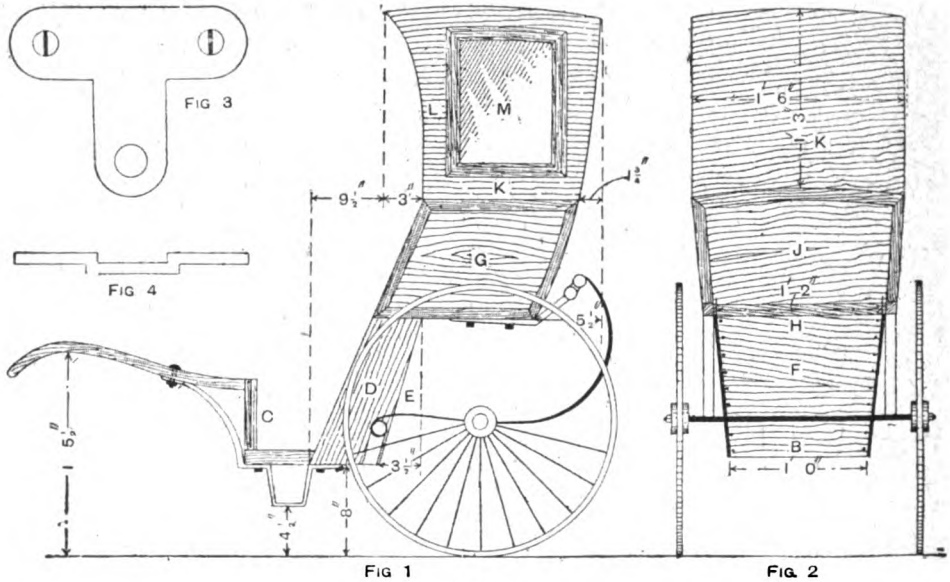


FIG 1 FIG. 2

Goat Chaise.

and true on three edges, and get the bevel for the outside from Fig. 2. Then box out the top inner edges ¼ in. each, and put in a board B (Fig. 2) crossways of the grain. This board is compassed in 1½ in. at the front (see C, Fig. 1). The rockers D are ½ in. thick, 5½ in. at the bottom, and 4½ in. at the top, by 1 ft. 1½ in. deep in a square line, and are boxed out on the back edge E ¼ in. each way to take the heel panel F (Fig. 2). The rockers are fixed at the bottom with No. 10 1-in. screws, and the top panel G is 1 in. thick by 1 ft. 1½ in. long on the bottom, and screwed on the rocker 1 in. down, the screws being put in from the inside of the rocker. The seat H (Fig. 2) is ¼ in. thick, and is screwed under the side panel, and fitted between the rockers. Being included in the depth of the panels, it must be let in flush at the back ends. The back panel J is 10½ in. deep in the centre by ¼ in. thick, and should be boxed into the end of the side panel ½ in. on by ¼ in. deep, and fixed with ¾-in. brass panel pins. The mouldings round the body are 1 in. wide by ¼ in. thick, mitred at the corners, and the front board is 7 in. deep, and in two parts, so as to be bent to the sweep, the grain being perpendicular. The shafts are 1 ft. 9 in. long by 1¼ in. square, bent in one piece of wood from point to point, and are fixed by screws to the panel, being supported by an iron stay. The head K (Figs. 1 and 2) is portable, so as to have an open or a closed chaise. The side pieces L (Fig. 1) are 1 ft. 6 in. long on the top by 1 ft. 1¼ in. on the bottom, and ¼ in. thick, and can be framed together. The glass windows M are 11 in. deep by 8½ in. wide, and the moulding around them may be metal bead, with shanks soldered into the back. The corners being mitred together, the back panel should be boxed into the side panels, and fixed with 1½-in. brass panel pins. To carry the roof boards, four hoopsticks ¾ in. wide by ½ in. thick are let in flush with the top of the side, which is bevelled to the shape of the roof, and for the covering ¼-in. pine should be used. Give it two coats of light lead colour, puttying all nail holes after the first coat; then give it a coat of smudge paint, and when that is tacky, put on some moleskin, and sleek it down from the centre, turning it over the edge of the roof ⅝ in., and then tacking it down to keep it watertight. A bead ¼ in. wide round the back and sides will hide the tacks. The wheels are 2 ft. in diameter, the C springs having one plate. The axle is ½ in. square, with a washer and linch pin, and brass caps outside. When the head is finished, three small iron plates (Fig. 3) are fixed inside on the bottom, two near the front of the panel and one in the centre of the back; they slip into sockets (Fig. 4), and are fixed by a screw.

Re-varnishing Tacky Seats.—For removing tacky varnish, mix thoroughly together equal parts of spirit of turpentine and spirit of wine, adding a little carbonate of potash to unite the liquids. Pour a small quantity on a piece of felt or flannel, and rub briskly until the varnish is all removed. Then sponge down well with soap and water. Before re-varnishing the work, allow it ample time to dry. Then apply a coat of glue size, which should also be allowed to dry. The work is then ready for varnishing. If the seats are interior fixtures they should be given two coats of hard church oak varnish, or a varnish made by mixing 1 part gold size with 7 parts of inside oak varnish, but for exterior use a more durable varnish will be required. Carriage or copal varnish will be most suitable, and should be mixed with about 1 part gold-size to 7 parts varnish. This will give to it good drying properties, and prevent stickiness. The above proportion of gold-size should not be exceeded, or otherwise the work will be liable to crack. Another essential feature of successful varnishing is to apply it in a warm atmosphere, free from damp. Dampness in the air causes blooming and other evils.

Sulphate of Iron.—Sulphate of iron usually is made from iron pyrites occurring largely in shales from the coal measures, and the shales are piled in large heaps and watered from time to time; the iron pyrites is thus oxidised with the formation of sulphate of iron and free sulphuric acid. The water running from these heaps is collected in tanks, and scrap iron is added to it to neutralise the free sulphuric acid; it is then evaporated until, on cooling, the sulphate of iron crystallises out. Sulphate of iron, or ferrous sulphate, occurs in pale green crystals, and may also be obtained by dissolving scrap iron in dilute sulphuric acid. It is used in dyeing, ink-making, colour making, and in the manufacture of fuming or Nordhausen sulphuric acid. It is one of the cheapest chemicals in existence, but it is always a marketable commodity.

Use of American Whitewood.—American whitewood readily takes any kind of water or spirit stain, and a further advantage is that it takes a good polish. Whether the wood is suitable for furniture depends largely on the usage the furniture will have to bear, as the wood is easily dented when knocked by any hard object. The more prominent or exposed portions of the furniture should be of a harder wood. The ample width and freedom from knots of American whitewood renders it particularly adaptable for furniture that is not likely to be subject to hard wear, as from frequent removals; but the wood is of plain figure, and on large surfaces has a rather tame appearance.

Stresses and Scantlings for Roof Truss.—Fig. 1 of the accompanying illustrations shows the frame diagram of a roof which is a tied collar beam truss. Fig. 2 shows the stress diagram for vertical loading, which is the common method, the total load being taken at ½ cwt. per ft. sup. It is, however, more correct to take the wind as acting on one side only, as in Fig. 3, and then this gives three conditions of the truss—(1) fixed both sides, (2) fixed only on side next wind, (3) fixed only on side opposite wind. The stress diagrams for these three cases are shown in Figs. 4, 5, and 6. Taking the maximum stresses found under all conditions as in Fig. 7, and allowing 1½ cwt. per sq. in. compression on the timber, and 4 tons per sq. in. tension on the iron, the scantlings will be as marked in Fig. 7.

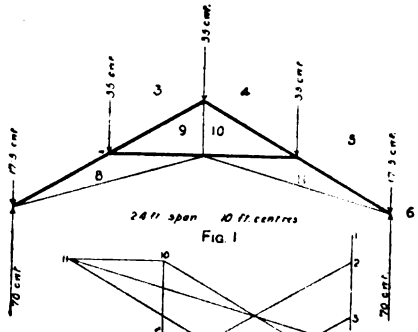


Fig. 1

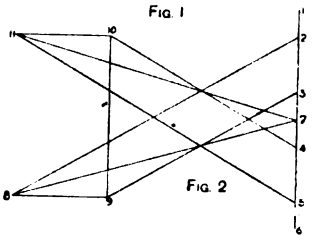


Fig. 2

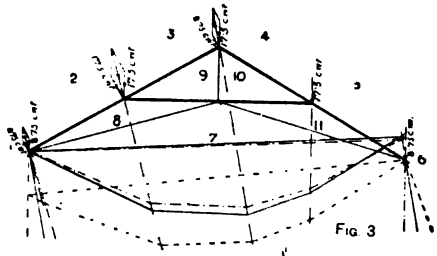


Fig. 3

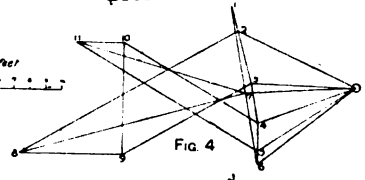


Fig. 4

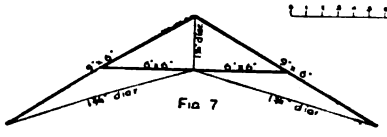


Fig. 7

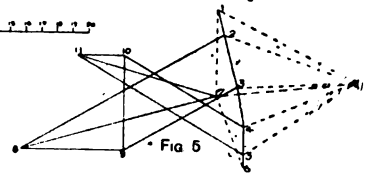


Fig. 5

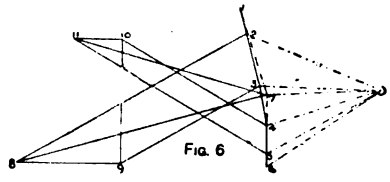


Fig. 6

Stresses and Scantlings for Roof Truss.

Nut-brown Oak Stain for Picture Frames.—The dark nut-brown oak stain used on picture frames may be made by dissolving one pennyworth of bichromate of potash in 1 pt. of rainwater; then add as much vandyke brown as will give the desired colour in two applications. The potash solution turns the wood darker without any colour pigment; this should be borne in mind, and experiment be made on any odd pieces of similar wood before the preparation is used on the finished article. Burnt brown umber also gives a useful shade, or, if desired, a portion of each may be added to the potash. In application, the wood being quite clean, the stain is brushed on rather liberally, and then well rubbed in with rag; wipe off the surplus, and always finish in the direction of the grain or long way of the wood.

Removing Stains from Carpets.—Stains of a rusty colour can be removed from a Wilton carpet in the following way. Place a large dinner plate or tray underneath the stained portion. Mix equal parts of cream of tartar and citric acid (this can be bought ready mixed under the name of salts of lemon), saturate the stained portion with hot water, and rub on the salts with a smooth piece of wood or bone until the stains disappear; then well rinse in clean cold water and hang the carpet up to dry. Or, instead of salts of lemon, oxalic acid, followed by a very weak solution of chloride of lime (bleaching powder), may be used; this is suitable for very light coloured carpets. One of the best methods of reviving all-wool carpets is to wipe the surface with a large swab of soft cloths or with a very soft bristle brush well charged with a solution made by dissolving an ox-gall in a pail of water. The ox-gall can be procured from a butcher's. Before using the solution the carpets should be well brushed or beaten.

Determining Capacity of Cask.—To determine by measurement the capacity of different sizes of casks, multiply the circumferences of the top, bottom, and belly of the cask separately by 7 and divide by 22 to produce the outside diameter in each case. Then subtract double the thickness of the stave to produce the inside diameter. Add the three reduced diameters together and divide by 3 to produce a mean diameter. Multiply the mean diameter by itself and the product by the height or length (inside measure) and divide by the factor 353, and the answer will be imperial gallons. The length of the two chimbs (that is the part projecting beyond the head) and the thickness of both heads must be ascertained and deducted from the outside length, and advantage must be taken of any holes in the head or sides to procure these measurements, and if there is a hole in the bellied stave midway between the two ends, take the diagonal by means of a rod, measuring both ways, and get a mean between the two measurements in inches and tenths. Multiply the cube of the mean diagonal by 3 and divide the product by 1,331; the answer will be the contents in imperial gallons.

Making Manganese into Blocks.—Manganese for batteries is usually in the form of small granules. If required, the manganese may be made into blocks by powdering and mixing it with a small quantity of treacle, pressing in iron moulds, and then heating the moulds and contents in a furnace until all the volatile matter has passed off. This will leave the manganese cemented into blocks by carbon. Another method is to mix the manganese with 10 per cent. of clay, make into a paste with water, mould, and burn in a furnace.

Colouring Vaseline Green.—The so-called aniline colours soluble in oils would be the most suitable for colouring vaseline green; these colours may be procured in all varieties; a green could be obtained either from green alone or by blending a blue and a yellow. The vaseline should be melted by gentle heat and a very little of the colour stirred with it till thoroughly dissolved. Most of the colours are not destroyed by carbolic acid; it is probable they will be improved, but this can be tried on a small scale first.

Small Birdcage.—Below is a description of a linnet cage simple to make. It is 6¾ in. wide, 4½ in. deep, and 7¼ in. high, and can be made from deal or pine, the outside being usually stained green. No dovetailing or rebating is required, all the joints being butt joints. The top and bottom A are ½ in. thick, 6¾ in. long, and 4½ in. wide; they are connected at the front by two pieces B, 7¼ in. long, ½ in. wide, and ½ in. thick, and at the back by a piece C, which is 7¼ in. long, ½ in. thick, and 6¾ in. wide. The side D is 3¾ in. wide, 3½ in. deep, and ¼ in. thick, and is fixed by tacks through the upright B and the back C. The opposite side E (see Figs. 1 and 2) is 3¾ in. deep, and the front F is 5¾ in. long, 3½ in. deep, and ¼ in. thick.

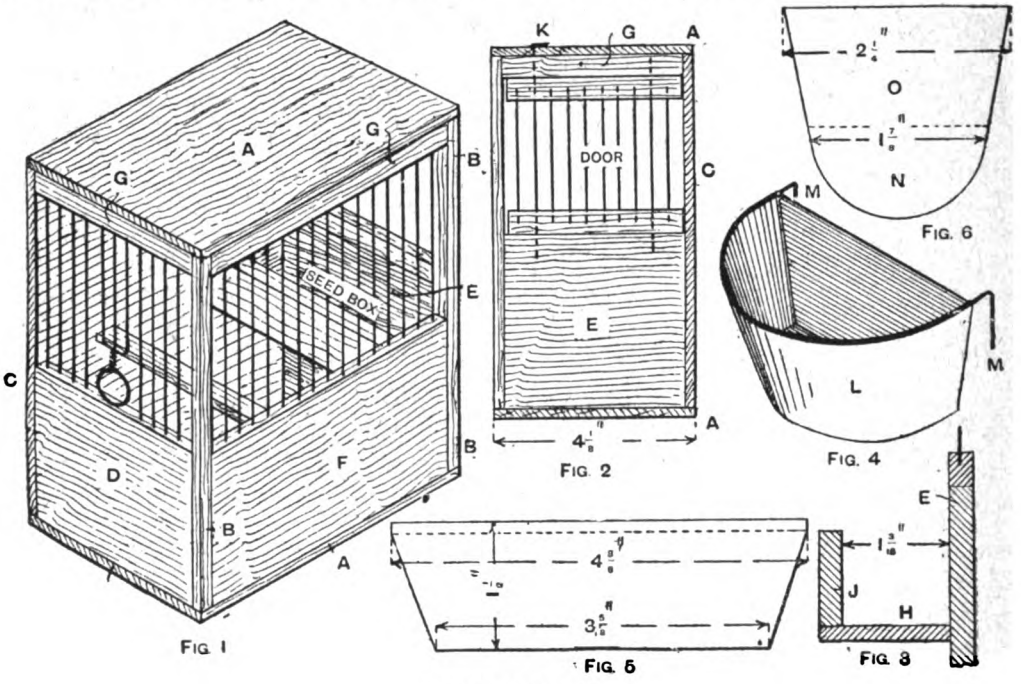


FIG. 1. FIG. 2. FIG. 6. FIG. 4. FIG. 5. FIG. 3.

Small Birdcage.

Under the top A are fixed three strips G, ⅞ in. deep by ¼ in. thick, into which the wires are fixed. The two side strips are 3¾ in. long, and the front one 5¾ in. long. The seed trough is formed by fixing two pieces the shape shown in Fig. 3. The bottom part H is 1⅛ in. wide, 3¾ in. long, and ⅛ in. thick, and the front J 1 in. deep, 3¾ in. long, and ⅛ in. thick; both pieces are fixed by tacks through the back, the front, and the side. The wiring can be done before the strips G are inserted. The wires are fixed in the pieces G, and then let into holes drilled in the sides and the front. About 13 ft. of wire will be sufficient. Twenty-three pieces, 4⅛ in. long, should be cut and let into the pieces G, the sides D, and the front F, for about ⅛ in., leaving about 3⅛ in. showing. All the front wires and eight at the left side, are of the same length (see Fig. 1); the three centre ones are cut to suit. The door consists of two pieces, ⅛ in. deep, ¼ in. thick, and 3⅜ in. long, joined by wires, as shown in Fig. 2. All the wires for the door, excepting the two long ones shown, are about 3⅛ in. long. The others are longer, the right-hand one to form the hinge, and the left-hand one K to fasten the door. The perch, ⅜ in. wide, ¼ in. thick, and 3¾ in. long, is fixed to the back and the front. No movable tray is shown, but this can be inserted if required. The water-pot is shown complete by Fig. 4, and is made of tin, the side L being cut to the shape shown in Fig. 5. This is 4⅛ in. wide at the top, 3⅜ in. wide at the bottom, and 1⅜ in. deep, plus about ⅛ in. for the beading at the top. This is bent to shape (see Fig. 4), the ⅛ in. being bent round to take the thin wire M for fixing the pot to the cage. The piece for the front and the bottom is shown in Fig. 6, and is bent across the dotted line, so that the part N is the bottom and O the front. It is 2½ in. wide at the top, and 1⅝ in. wide at the dotted line, the curved part being 1 in. deep, and the other part O to dotted line 1⅛ in. deep. It is soldered to the semicircular portion. A small pediment may be run round the top, and an ornamental beading round the bottom.

Material for Filling Deck Cracks.—For filling seams of decks there is nothing better than marine glue of good quality. Do not overheat it or use any grease in caulking the seams, or the glue will not adhere.

Tobacco Manufacture.—Tobacco as imported is already cured, so that but little requires to be done to prepare it for use. Abroad, the plant is gathered and hung up in bunches in a large shed to dry. After drying to a certain extent, the doors of the shed are opened during a damp day, so that the leaves become moist and can be handled without breaking. The bunches are then removed, piled in a pit, and allowed to ferment; again opened out to the air to stop fermentation, and packed for export. On arrival in England, as the tobacco has become too dry to handle, it is damped, and the stems and midribs are cut out. The leaves are then pressed into a machine provided with a falling knife, and cut into shreds. The cut material may then be dried to some extent by placing in canvas bags and blowing cold air through it. This is not always done, the tobacco being sold as it is, containing 20 per cent. or even 30 per cent. of moisture. Cake or plug tobacco is, of course, pressed without cutting. Sometimes sugar is added, though this is believed to be illegal. Sailors sometimes make plug tobacco by moistening the leaves with rum to soften them and then wrap them up in a cloth, making a roll which is tapered at both ends. This roll is bound tightly with string, which is unwound and drawn tighter from time to time until the leaves are supposed to be properly cured; the roll is then cut up as required. It is very good tobacco. Good tobacco leaf, on burning, yields a smoke which is free from the acridity usually found in the smoke from plants. It is mild and fragrant, and does not affect the lungs so much. Then, again, the nicotine which the plant contains is volatilised, and in small quantity produces a soothing effect which cannot be got by the use of any other plant, with the exception of the harmful opium.

Fisherman's Box.—Very convenient dimensions for the watertight fishing box here described in detail would be length, 15 in.; width, 9 in.; and depth, 12 in.; a box of this size would be found to be fairly comfortable when used as a seat. The box may be made of pine full ¼ in. thick, or of ¼-in. mahogany, which will clean up to ⅜ in. thick when finished. Prepare two pieces for the front and back 15 in. long by 12 in. wide, plane them up and square the ends, then work a rebate on the bottom edges and at the ends $\frac{3}{16}$ in. deep and of a width equal to the thickness of the stuff. The ends are next prepared and cleaned up to 12 in. by 8½ in., and a rebate is worked on the bottom edge. Now cover the joints with some good glue, then nail the sides on to the ends with ¾-in. brads or panel pins. If the box is to be provided with a partition as shown by Fig. 1, grooves $\frac{3}{16}$ in. deep should be worked at A before the box is nailed together. The joints are shown in the illustrations half-lapped together, but of course a better job would be made by dovetailing them. When the glue is thoroughly dry the nails are punched in below the level and the joints cleaned off at the front, or a pair of hooks and staples may be used instead. The box can be either painted and varnished or polished, but if finished with French polish, it will be advisable to give a coat of copal or good carriage varnish to keep out the wet. Strap staples B (Fig. 4) for screwing on the ends may be obtained from a harness-maker or an ironmonger, or a handle may be fitted to the centre of the lid; but a handle is in the way when the box is used as a seat.

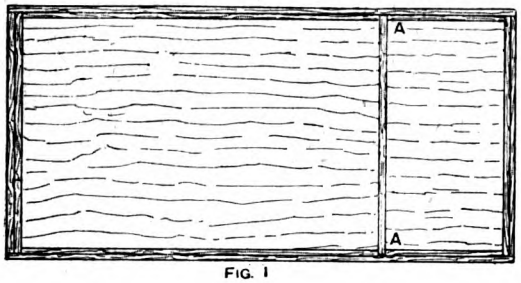


FIG. 1

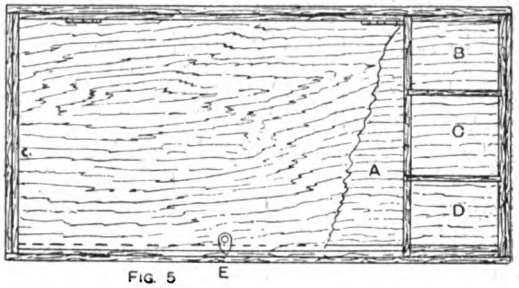


FIG. 5

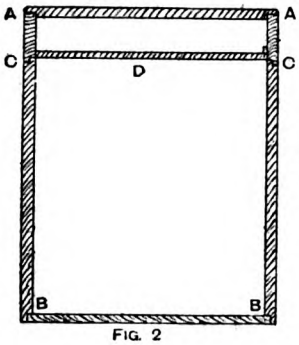


FIG. 2

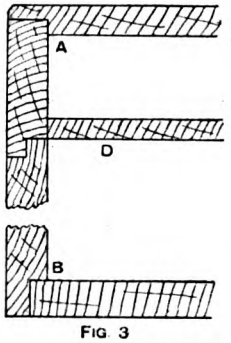


FIG. 3

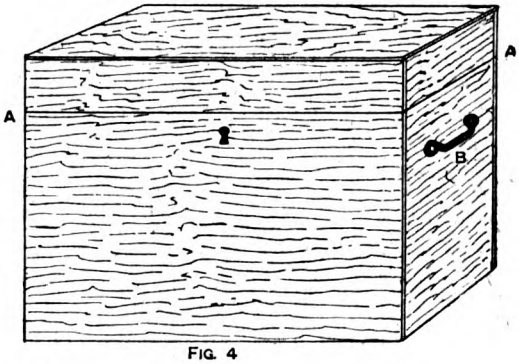


FIG. 4

Fisherman's Box.

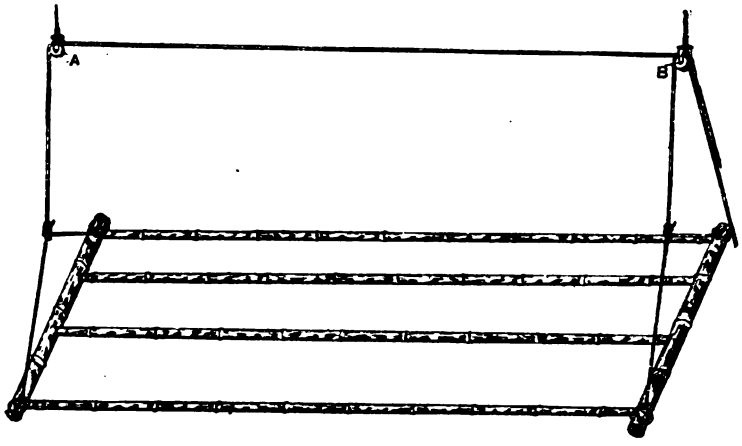
Measurement of Stairs.—Measure stairs by the foot super, handrails by the foot run. The shape of stairs makes no difference in the measuring, but it does in the pricing, all wreathed work being priced at four and a-half times straight work. Winders may be measured net or square; whichever method is adopted should be stated in the description column. In order to measure net, add the width of the tread at the wide end to the width at the narrow end, and divide by 2; add to the product the height of the risers, and add 1 in. for nosing; multiply the sum by the length between the strings plus the housings if close, out to out of cut strings, and multiply this by the number of steps and add one rise for the landing. In order to measure square, take the width of the winder at the widest end, add the rise plus 1 in. for nosing, and multiply by the length; multiply this dimension by the number of steps. If the risers are tongued, measure the tongues by the foot run, and describe as one edge or two edges, as the case may be. If the treads are jointed and feather-tongued, describe them as such. For the strings, measure the length on the top edge with tape; multiply by the breadth, describe the thickness, and state whether plain sunk, or double sunk and moulded, whether laminated, backed and staved, or built up; state whether mitred to risers, whether glued, blocked and nailed, or screwed, and whether balusters are dovetailed; specify carriages by foot run. For the handrails, measure the run on the back of the rail with tape, add 4 in. for housings if finishing in newel post or wall. Describe size and section, whether sunk for balusters or grooved for core. Enumerate the caps and handrail screws.

with the plane. A piece of stuff equal to the size of the top is next prepared and rebated $\frac{3}{16}$ in. all round to fit in as shown at A in Figs. 2 and 3, then the edges are coated with glue and the lid is nailed on. The method of fitting the bottom into the rebates prepared in the sides and ends is shown at B (Figs. 2 and 3), and when this has been nailed in and the box is dry, the box may be cleaned off with the plane and sandpapered up. A marking gauge is now set to 1½ in. and the line for the joint of the lid is scribed on as shown at A (Fig. 4), and the box may be cut in two along this line with a fine-toothed tenon saw. In Figs. 2 and 3 a rebated joint is shown between the lid and box at C, the object of this being to keep rain from penetrating; but to fit the lid on in this manner it will be necessary to make the parts separate and fit them together. The partition dividing the body of the box at A (Fig. 1) may now be fixed and the lid, if desired, fitted with a tray and partitions for carrying fishing tackle. A useful arrangement for this is shown by Fig. 5. The inside of the lid is fitted with a hinged flap which is shown in section at D (Figs. 2 and 3), and the space between this and the lid is divided into convenient compartments for hooks, lines, etc. Fig. 5 gives a view looking into the lid when open, and a portion of the flap is broken away at A to show some of the divisions B, C, and D. The flap may be secured as shown at E with a turnbutton made out of a piece of ¼-in. brass plate secured with a round-headed No. 6 wood screw. The lid can now be hung to the body of the box with a pair of 2-in. by ⅝-in. brass butt hinges, and a strong lock can be fitted

Silicate of Soda.—Soluble silicate of soda is made according to one method by heating a mixture of 60 parts of white sand, 33 parts of soda ash, and 1 part of charcoal in a reverberatory furnace. The silicate also is produced by heating powdered flint with a concentrated solution of caustic soda under pressure. The second method produces a thick solution like syrup, and a similar solution is prepared in the first method by boiling the melt with a little water, decanting the clear syrup.

Staining Glass.—Stained glass is produced by several methods. For ordinary stained glass, metallic oxides are added to the usual ingredients of white glass. Ruby glass is formed by the addition of oxide of copper, and heating the glass in a reducing atmosphere; or it is produced by the addition of finely divided gold. Oxide of copper is also used in the production of green glass, while amber-coloured glass is obtained by the help of antimoniate of lead. Another kind of stained glass is prepared by dipping a ball of pasty glass into a bath of molten coloured glass, and then blowing the two together; this kind of glass is known as flashed glass, all the colour being contained in a very thin tinted film spread on the surface of white glass. Stained glass is also often produced (for artistic purposes) by painting fusible enamels on the surface of ordinary glass, and then burning in the colours in a muffle furnace; stained glass windows are produced in this way. The ordinary coloured lacquers may, of course, be used for staining glass, but they give a very poor and dull effect.

Bamboo Clothes-airer.—The illustration shows a clothes-airer either for domestic or laundry use, its size being 6 ft. 6 in. by 3 ft. Besides being lighter it is also not so unsightly as an airer made in wood. The two end pieces should be of 2-in. bamboo, 3 ft. long, and the rails are 1 in. thick by 6 ft. 6 in. long. The sketch shows four rails, though five or six need not be considered too many. Racks are often made 10 ft. or 12 ft. in length, with but

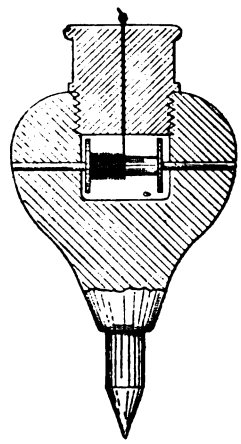


Bamboo Clothes-airer.

three rails. Generally, the longer the rails the less the number required. The rails should be plugged with wood about 6 in. and well glued in. The thicker pieces are bored about 2 in. from the ends, and equal spaces are allowed between the rails, the ends of which are rasped and tightly fitted into the holes. They are then glued in and cramped up with strings. Before removing the strings, the end pieces should be bored and countersunk for 3-in. screws, which are driven into each end of the rails. The rack next requires plugging at the corners, and terminals should be put on. Varnish well where the rails are let in to prevent any moisture from the clothes softening the glue. A single pulley A and double pulley B are required, and can be bought at any ironmongery stores very cheaply. Two 4-ft. 6-in. lengths of rope are cut off, the ends being tied to each corner of the rack and the remainder divided and attached as shown. To find the joists in the ceiling for the pulleys, it will be necessary to examine the floor of the room above and measure from the wall. The ropes are then put through the pulleys and bound together as shown with strong cord. When pulled up, the rack should be about 6 in. from the ceiling. It is kept up by the hand rope being wrapped round the cleat-hook, which may in most cases be screwed to the woodwork of the window framing.

Inlaying Pewter and Copper in Oak.—Below are hints on inlaying pewter and copper in oak. If the inlaying takes the form of plain banding the metal should be bought ready cut; uniform width of the band is thus assured, as the metal is cut by roller cutters in a machine. The channels for the reception of the metal should be of equal depth all through. The lines are cut with a tool resembling a joiner's cutting or marking gauge, the space between the lines being cleared out with a router. Circular or semicircular grooves are cut with a strong pair of joiner's wing compasses, which can be secured by a set screw, one leg being bent in order that the cutter may work plumb, this leg being used as the cutting leg and filed to the shape of an inverted $\wedge$; the cutter should be the bare width of the stringing, which should in all cases fit tightly into the grooves, but not so tightly as to chip the top edges and cause the work to lack a clean finish. The corners should be mitred and the metal fit in the channels without buckling up. When inlaying wood, stringing is commonly practised in order to clear the channels to such a depth that the inlay will stand slightly above the surrounding surface, so as to allow for cleaning off and glass papering, but this practice should be avoided as far as possible in the case of metals lest particles of metal should be forced into the grain of the wood. Glue is generally used for securing the inlay in position; a thick solution of shellac dissolved in wood naphtha is considered by some workmen to be better than glue. Fine pins driven through the metal in a slanting direction afford greater security than glue or shellac if long lengths of metal are used; pins are also preferable in the case of shields or centre-pieces.

Improved Plumb-bob.—In the plumb-bob here illustrated, the point of superiority is that there is no difficulty in keeping the string from getting entangled. The bob contains inside a small drum pivoted on a piece of fairly stout indiarubber cord. The string is wound round this drum and passed through the plug on the top of the plumb-bob. The string is then knotted to



Improved Plumb-bob.

keep it from going right in. When in use, pull the string out and this will twist the indiarubber; then when released from the weight of the plumb-bob itself, the string will fly back into the inside and thus prevent entangling. The drum need only be of tinned iron, and the plug at the top should be screwed with a ¼-in. gas thread.

Slating Westmorland Roof.—The method of setting up the laths and holing the slates for a grey Westmorland roof is as follows. Sort out the slates into graduated lengths, then suppose them to be head-nailed and to have a lap of 3 in.; the margin for the first course and the position of the batten or lath will be found as follows:

	in.
Length of slates in first course, say	26
Length of slates in second course, say ...	25
Difference =	1
Net lap required	3
Nail hole to head of slate	1

Length of slates in first course 26 in. less 5 in. = 21 in.

	in.
21 divided by 2	10½
Add difference of length...	1
Gives margin of first course	11½
Add net lap	3
Gives centre of first row of battens	14½

The battens for the second course will be 14½ in., less difference in length of slates 1 in. = 13½ in. from the last batten, centre to centre, and the spacing for the remaining battens will be found in a similar manner.

Boring Holes in Bamboo.—Ordinary centre-bits as employed in woodworking may be used for boring holes in bamboo poles where the holes are small in comparison with the pole in which they are to be made. But as the hole to be bored approaches, in diameter, to the thickness of the pole itself, centre-bits do more and more unsatisfactory work, unless the hollow middle of the pole is filled with wood, and this, of course, is only possible near the ends of the pole. Bamboo workers get over the difficulty by the use of a bit specially modified for bamboo fitting. A short twist-bit of Jennings' pattern is procured, and the screw centre-point of the bit is filed down to a triangular pointed shape. This is done because the unaltered bit feeds itself too rapidly and invariably splits the work; but with a plain triangular point the feed rests with the operator alone. Even then the centre-point is apt sometimes to start a split, and in very particular work the precaution should be taken of boring a bradawl hole first, especially when a large hole has to be made near the end of a pole.

Kiln for Firing Glass for Leaded Lights.—A kiln suitable for firing glass for leaded lights may use either coal or gas. A kiln for use with gas and one for coal are very similar in construction. The illustrations show both forms in section and in plan, and the arrangement of the flues may be seen. The furnaces are of the kind known as muffle furnaces, the muffle A being used as a chamber for firing the glass.

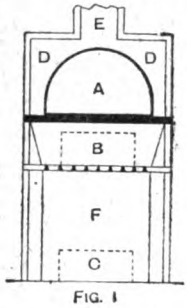


FIG. 1

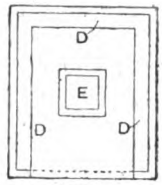


FIG. 2

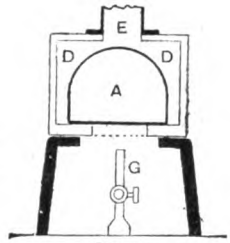


FIG 3

Kiln for Firing Glass for Leaded Lights.

Furnaces for use with coke are built of fireclay bricks puddled with fireclay; the gas furnaces are constructed of fireclay slabs bound with hoop iron. The illustrations show in Fig. 1 a section of a coke muffle furnace; in Fig. 2, a plan of a coke muffle furnace; in Fig. 3, a section of a gas muffle furnace; the letter references are A, muffle; B, stoke hole; C, ash hole; D, flues; E, chimney; F, ashpit; G, gas burner.

Wood Preservative.—The following preparation is excellent for preserving exterior woodwork, such as railway sleepers, posts, rafters, etc. Dissolve by frequent agitation 14 lb. of coal-tar pitch in 1 gal. of benzine, and stir well into 12 gal. of anthracene oil. In another vessel dissolve 2 lb. of pure rubber in ½ gal. of solvent or coal-tar naphtha, and then add ½ gal. of carbolic acid. Mix the contents of both vessels thoroughly. The preservative should be applied with a brush. It is very effective alike against the action of dry rot, decay, and dampness in all woodwork, and the cost of it is very small.

Wall Paper Showing Glossy Patches.—The reason of wall paper showing glossy patches along the seams and at other places where the brush and roller have been used is that the paper has been printed with an aniline colour. Papers printed with fugitive colours of this type show a glossy surface when submitted to friction; this is one of the chief objections against papers of this class. Pigment or mineral colour papers are slightly duller in appearance than aniline papers, but are free from this glossiness. Many attempts have been made to overcome this defect, but up to the present without success. The mordant used in fastening the dyes is one of the principal causes of glossiness, which can only be avoided by the greatest care in hanging and handling the paper. Parts of the paper that are very objectionably glossy may be improved by very gently dabbing or rubbing the affected parts with a chamois leather dipped in water. This method can only be used with papers that are printed in various shades of one colour. Moistening the chamois leather with steam from the kettle is the safest method.

Equal Division of Triangular Piece of Land.—A triangular piece of ground, the sides of which are 60 chains, 80 chains, and 100 chains long respectively, is to be divided into three equal parts, all the parts to have equal areas. First test triangle in order to see whether the 60-chain end is square to the 80-chain side, thus $80^2 + 60^2 - 100^2 = 0$, or $6400 + 3600 - 10000 = 0$, proving the angle to be a right angle. Now the area of the whole triangle will be $\frac{60 \times 80}{2} = 2400$ sq. chains, which is the content of the plot that is to be divided into three equal parts, each part containing 800 sq. chains. Measuring from the apex, double the distance will contain four times the area, or the area varies as the square of the distance. If 80 chains distance gives 2400 sq. chains, then 2400, 80^2, 800, or $\sqrt{\frac{80^2 \times 800}{2400}} = 46{\cdot}19$ chains for the first division line from the apex. Then $\sqrt{\frac{80^2 \times 1600}{2400}} = 65{\cdot}32$ chains for the second division. Geometrically the

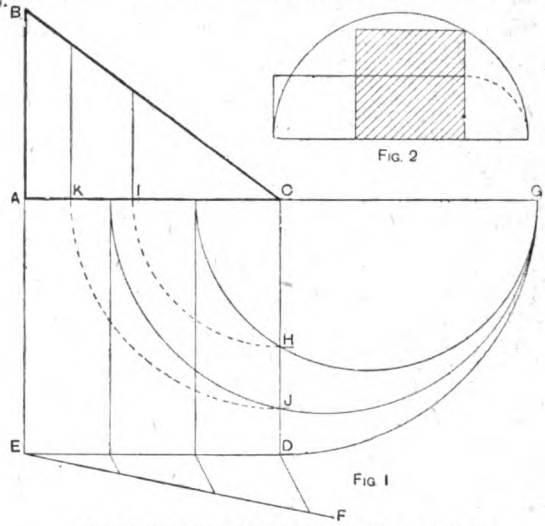


FIG. 1

FIG. 2

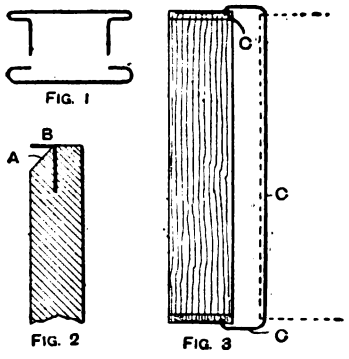
Equal Division of Triangular Piece of Land.

division would be obtained as follows (Fig. 1). Draw the triangle A B C; upon the side from which the divisions are required draw the square C D E A. Trisect line E D by the usual method for dividing a line into any number of equal parts, and draw division lines. Turn down C D into line with A C, bisect the distance from G to the first division, and describe a semicircle cutting C D in H; from C with radius C H describe the arc H I, and a vertical from I will be the first boundary. Bisect the distance from G to the second division, describe a semicircle cutting C D in J, describe the arc J K, and a vertical from K will be the other boundary line required. The principles involved in this solution are, first, that the areas of similar triangles vary as the squares of like sides; and second, the construction of a square equal in area to a given parallelogram, which is shown in its simplest form in Fig. 2.

Water-hammer in Pipes.—This is caused by suddenly arresting the flow of water through the pipes. In service pipes water-hammer is caused by suddenly closing a draw-off cock out of which water is flowing. The same noise is heard in the drive pipe of an hydraulic ram when the working valve is dashed up to its seating; also in the delivery pipe of a pump when the pump is worked at too high a speed and is without an air-vessel. In the case of a draw-off pipe an air-vessel should be fixed as near the draw-off cock as possible; the same remedy is suitable for a pump delivery pipe. In the case of an hydraulic ram an air-vessel should not be attached to the drive pipe, as the shock caused by suddenly arresting the flow of water is necessary to the working of the ram. An air-vessel is used for the purpose of slowly arresting the flow of water through the pipes, and thus preventing shock or water-hammer.

Faulty Chain of Lever Watch.—When the chain of an English lever watch turns over on the barrel it shows it is badly strained. Take the chain off, straighten it out perfectly, and gently tap all the rivets over a flat steel stake. Reverse the hooks, putting the barrel hook on the fusee end of the chain, and see that the surface of the barrel is flat and smooth. Then put the chain on again, and if the fault is not remedied, a new chain will have to be fitted.

Binding Loose Book Parts, etc.—The binder here illustrated affords a means of binding together parts of periodicals, etc., at a cost per volume of about a farthing. It consists of a backboard having two wire staples, as shown by Fig. 1, top and bottom, to which the papers are laced with twine. The backboard is a piece of wood of the same length as the papers, and the width is equal to the bulk of papers when pressed together by the hand. On the inside face is a slight bevel A (Fig. 2) at each end for passing the twine between the board and the staples B, and on the outside the sharp edges, lengthways, are rounded off. The staples may be made of stout hairpins twisted into a chain ring, the length of which, when completed, should be ¼ in. less than the width of the board, and about ¼ in. wide, the free ends being turned up, as the staple lies flat, at right angles, at about ¼ in. from the bend, and then driven into the wood at each end; the long side is flush with the inside face of the board, leaving a narrow opening. The book parts, papers, etc., may be bound singly as they come to hand. First tie the twine to one staple, and placing a paper with the back of the fold to the board, pass the twine down



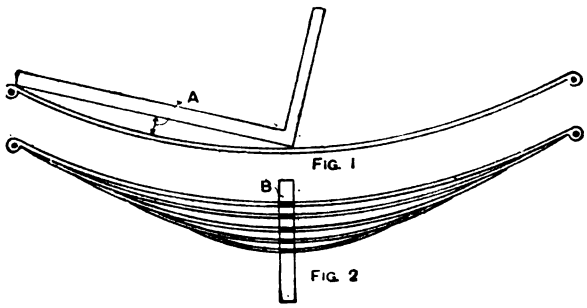
Binding Loose Book Parts, etc.

the inside and lace it to the other staple; then another paper may be placed, and the lacing commenced where the other left off. Keep the twine taut while binding. A temporary fastening may be made by drawing the twine in a loop through the staple, inserting in it the free end, and drawing tight. A wire hook will assist in lacing, and in adding twine let the join be inside the fold for neatness. Fig. 3 shows the binder with one length of twine C attached, the dotted lines representing the periodical. Two holes bored in the backboard about ¼ in. from each end, and a string passed through and tied inside, will be a convenience for handling the set until the volume is complete, when it will pass to the bookshelves. The sides can have covers added on completion, and may be embellished according to the taste and skill of the owner by woodcarving or leatherwork, or any of the fancy needlework.

Hardening Plaster-of-Paris.—Plaster-of-Paris moulds are made much harder if alum be dissolved in the water which is used for mixing, also by steeping the moulds in skim milk and then drying. A very hard material may be made by curdling skim milk with a little acid, collecting the curd on a cloth and pressing out the whey, then dissolving the curd in a solution of about one-fourth its weight of borax in water. This solution should be used for mixing with the dry plaster-of-Paris for making the moulds.

Avoiding Rust on Cycle Frames.—The borax used in brazing the joints of cycle frames, being of an alkaline nature, will quickly eat into the metal and cause the work to rust rapidly beneath the surface of the enamel, which eventually falls or cracks off. The alkali may, however, be neutralised by sponging the parts over with dilute sulphuric acid or vinegar, finally washing or sponging off with warm water and well drying. Should there be the least sign of rust on any part of the tubing, apart from the brazing, this may be completely obliterated by thoroughly soaking and rubbing the metal with benzine and emery paper. The impurities in the composition of the metal would have no effect on the subsequent coat of enamel after the work had been thoroughly cleaned. The flint-like nature of the enamel would imprison any acid or chemical in the metal, the rust not being able to form unless the work had, previous to enamelling, been allowed to rust slightly. Rust when once promoted, no matter from whatever cause, will rapidly accumulate above or beneath any surface. Acids and alkalies produce rust more rapidly than any other known matter.

Setting up Carriage Spring.—Below are some hints on setting up a carriage spring that has been strained by over-weight or accident. First it will be necessary to find how much the spring requires setting up. Suppose this amount to be 2 in. Next take the spring apart from the carriage, and put it on the bench or fitting plate; place a straightedge across the top of the eyes, and measure the compass from the top of the back plate to the straightedge, and note the measurement with the weight off. In case of an elliptic spring, measure the inside span before taking the two halves apart; then take these apart, and measure separately the compass of each half, as sometimes one half is strained more than the other, and consequently will want more setting up than the other. However, both halves should be of equal compass. Next fix the spring in a vice, and take out the centre bolt, putting a piece of ¼-in. rod through the hole to prevent the spring falling apart. Next put the spring on the bench, and press all the plates up to each other so that the ends touch. Next take a piece of 1¼-in. cooper's hoop iron, about 8 in. or 9 in. long, and lay it across the centre of the spring at right angles to its length, and with a slate pencil mark the top and bottom



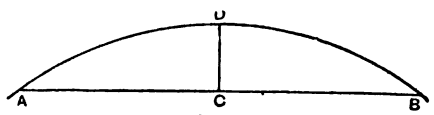
Setting up Carriage Spring.

edge of each plate. See whether the spaces between the plates are regular, that is, with the widest space between the back and second plate, and the width diminishing as the plates get shorter. If not, they must be made so in setting up the spring, otherwise the strains on the plates will be unequal. Next make a dot-punch mark on each plate, so as to get the plates in their right places, and note that a chalk mark on the dotted ends while working at the spring will save looking for the dot. Next set up the spring, taking the back plate first. If it is fairly regular, the sweep of the plate can be marked on the fitting plate, and a mark made 1½ in. above each eye will be all that is necessary. Next heat the spring plate black hot, taking care not to overheat it, or it will have to be hardened and tempered again. Next place the plate across the vice, and with a few blows with the hammer, compass the plate, till it touches the marks referred to. To find whether one half has got more compass than the other, a 2-ft. iron square is handy. Place one end against the centre hole, and the other along the top of the spring plate, and measure from the square to the spring plate, as shown at A (Fig. 1). Having got the back plate true and straight by a few blows on the edge, if necessary take the plates in turn and fit them, making each plate come up to the marks on the hoop iron B, as shown by Fig. 2. The spring is set up 1½ in. instead of 2 in., because when a spring is set up it is generally stiffer than it was before, and when it gets the weight on it again it will not go down so much. Therefore the carriage is sometimes higher than necessary, and requires swaging down; or the spring must be taken apart, and some of the compass taken out of it.

Cleaning Brass Door-knocker.—To clean a brass door-knocker that has become very black, take out the iron screws, and thoroughly clean the knocker in strong soda, brushing all dirt out of the indentations of the pattern. Then dip in sulphuric acid, polish with emery and oil, and finish off with crocus powder.

Fireproofing Chinese Paper Lanterns.—Chinese paper lanterns might be treated so that they would not burn, yet, if a flame came in contact with them, they would certainly char; there is no method of rendering organic substances like paper fireproof. Painting the lanterns all over with a strong solution of tungstate of soda would render them uninflammable, but it is probable they will not stand this treatment.

Calculating Radii of Large Circular Curves.—The following simple rule can be used for finding the radii of large circular curves, the centres of which are inaccessible. Place a straight rod, exactly 2 ft. long, in the curve as a chord (A B in the accompanying illustration), and measure the rise of the curve at the centre of the rod (C D in the figure). Express this rise as the fraction of a foot, add it to the same fraction inverted, and the result will be the diameter of the circle in feet; therefore, the radius will be half that result. Suppose the rise is 1 in.—that is, $\frac{1}{12}$ of a foot; that added to the same fraction inverted $\frac{12}{1} + \frac{1}{12}$, equals $12\frac{1}{12}$ ft., or 12 ft. 1 in., which is the diameter, and the radius is 6 ft. 0½ in. But an objection to this rule lies in the fact that, although it works out very nicely in a few particular cases, like 1½ in., which is ⅛ of a foot, etc., it becomes troublesome when the rise represents an awkward fraction of a foot, as, for instance, the rise of 3½ in., which is $\frac{7}{24}$ of a foot, or 5½, which is $\frac{11}{24}$ of a foot. These are inconvenient enough, while those rises which include an odd ½ in. or $\frac{1}{16}$ in. are worse still. Another method will, therefore, now be shown. Notice the following table, to use which it is only necessary to measure the rise on a 2-ft. chord and then find the radius from the table.



Calculating Radii of Large Circular Curves.

TABLE OF RADII, CORRESPONDING TO RISES AT THE CENTRE OF A 2-FT. CHORD IN CIRCULAR CURVES.

Rise.	*Radius.*	*Rise.*	*Radius.*
in.	*ft. in.*	*in.*	*ft. in.*
$\frac{1}{16}$	96 $\frac{1}{2}$	4	1 8
$\frac{1}{8}$	48 $\frac{1}{4}$	5	1 $4\frac{8}{16}$
$\frac{1}{4}$	24 $\frac{1}{2}$	6	1 3
$\frac{1}{8}$	16 $\frac{1}{4}$	7	1 $1\frac{1}{2}$
$\frac{1}{2}$	12 $\frac{1}{2}$	8	1 1
$\frac{3}{4}$	8 $\frac{1}{2}$	9	1 $0\frac{1}{2}$
1	6 $\frac{1}{2}$	10	1 $0\frac{1}{2}$
2	3 1	11	1 $0\frac{1}{2}$
3	2 $1\frac{1}{2}$	12	1 0

A little observation of the above will disclose a curious fact. In the first radius column the feet are inversely, and the inches directly, proportional to the rise; that is, as the rise increases, the feet in the radius decrease while the inches increase, all in the same proportion, and vice versa. This does not apply to the right-hand columns. Compare ½-in. rise with 1-in. rise; the rise is doubled, the feet in the radius halved and the inches doubled. It will be further noticed that the inches in the radius are exactly half the rise in every case in left-hand columns. To show the utility of these facts, suppose the radius for a 7-in. rise were not in the table and that it is desired to discover it. Since 7 in. is seven times 1 in., look up the radius for 1-in. rise, and divide the feet by 7, and add half the rise, thus:—

6 ft. divided by 7 = 10⅔ in.
Half the rise = 3½ „
Required radius = 1 ft. 1½ in.

Reference to the above table confirms this result. So that for any rise which does not appear in the table, the radius can be rapidly calculated from that of any tabulated rise (in the left-hand column) of which it is the most convenient multiple or factor. Take, for example, a rise of 1½ in.; this is 3 times ½ in., the radius for which, taken from the table, is 16 ft. $\frac{1}{8}$ in.

16 ft. divided by 3 = 5 ft. 4 in.
Half rise = $\frac{1}{16}$ in.
Required radius = 5 ft. $4\frac{3}{16}$ in.

As an example of obtaining a radius for a small rise, from that of a larger rise, take ¼ in. rise, using 1 in. rise (as per table). Since the rise is smaller, the feet must be increased,

6 ft. multiplied by 6 = 36 ft. 0 in.
Half the rise = $\frac{1}{16}$ in.
Required radius = 36 ft. $\frac{1}{16}$ in.

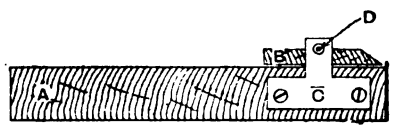
The range of radii which can be discovered by this simple rule is very large. For curves less than 1 ft. radius, or for very large curves, where measuring the rise on a 2-ft. chord becomes impracticable, any chord may be taken, and the following rule used. To find radii: Take half the chord, square it, divide by the rise, add the rise, and finally divide by 2. This rule formulated is:—

$$\frac{\left(\frac{\text{Chord}}{2}\right)^2 + \text{Rise}}{2}$$

The same rule can be used to find a radius of a segmental arch, of given span and rise, by substituting the word "span" for the word "chord," as Take half the span, etc.—

$$\frac{\left(\frac{\text{Span}}{2}\right)^2 + \text{Rise}}{2}$$

Photographic Mount Beveller.—Commercial mounts must be of stock sizes, and when a print is trimmed to a suitable size and shape, it is often impossible to fix it on one of those mounts, owing to the margins being unequal. In such a case the only thing to do is to make a mount to suit the picture. A bevelled edge always enhances a mount, whether home-made or otherwise,



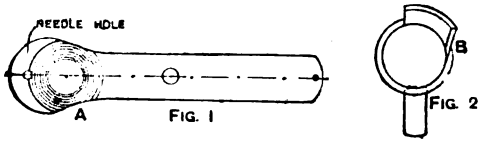
Photographic Mount Beveller.

but it is not always possible to make a clean bevel with the knife and straightedge unless the worker is accustomed to the use of these tools. The accompanying illustration, however, shows an apparatus which renders failure impossible. A baseboard A of wood has the front edge faced with brass, which should be raised about $\frac{1}{16}$ in. above the top. A strip B of wood, of the same length as the baseboard, is bevelled as shown, the bevelled portion being faced with brass, which must be smooth and even throughout its length. There must be no screws or nails protruding. Two brass T-shaped pieces C will be required with a hole drilled at the top of each. These pieces are screwed to the ends of the baseboard, and a pin D is screwed to B, and passes through the top holes. Two of these pins are required. A thin, narrow strip of wood may be screwed to the base at the far end, but it must be kept clear of B. This strip acts as a stop, and must be at a right angle to the front edge of the base. To use the beveller, the card, after having been cut square, is pushed under B, against the brass at the front of A, and against the thin strip of wood. The front of B is pressed down on the cardboard with the left hand, and by using a sharp knife pressed against the brass, a stroke from end to end of the cardboard cuts away the exposed edge and makes a clean bevel. One edge is cut at a time, but all four edges will be of the same depth if care is taken to keep the knife flat against the brass. An ordinary penknife will do, but a shoemaker's knife is best for the purpose. The arrangement here described could with little alteration be made useful to bookbinders and paper-box makers. The whole thing might be made in metal, and B could be adjustable so that different depths of bevels could be obtained: also a rod with a stirrup could be fitted to B for holding it down on the board, so that both hands could be used to push the knife, as would be necessary if thick boards were being worked.

Taking Out Clock Mainspring.—In any kind of clock in which the mainspring is confined in a barrel or a strip of brass, the clock must be run down before taking it apart. This can be done by removing the pallets and letting the train run, or, like a watch, by holding back the click and letting down gently. In an American or German clock in which the mainspring is not confined, first wind up the clock, then pass a clamp (off a new mainspring) over the wound-up spring, or tie it with wire. Then hold back the click and let the spring down as far as it will run. The clamp or wire will then confine the spring as in a barrel. To remove a mainspring from its barrel, take hold of its centre with the pliers and twist it in the direction of winding up, to ease the coils, at the same time pulling outwards. Handle it with a duster for safety.

Dressings for Leather Belts.—Here are hints on dressing leather belts to prevent them slipping. Grease that is applied only on the face of the belt coming in contact with the pulley will, of course, prevent adhesion. Some users of machine belts make an adhesive by mixing about 3 parts of resin with 1 part of tallow. This composition is applied hot, or in a liquid state. A solution of indiarubber, oil, resin, and tallow is also used as an adhesive. If the belt has become hard and dry, proceed as follows. Well cleanse the belt with hot water and soap, and rinse with clean warm water. While the belt is moist, rub well into it some dubbin, and let the belt dry at a tension. The dubbin may be made by melting over a fire some good tallow, and adding one-quarter its weight of cod-liver oil; allow to cool, when the dubbin will be ready for use. Whenever there is a tendency of the belt to slip, brush off any dust that may be on the belt, and place a little castor oil on the side next the pulleys. Should the oil fail to have the desired effect, take the belt up to driving tension. If the belt is worked on pulleys that are too small, it will slip, unless it is very much over-strained. The following is a good dressing for leather belts. Heat to about 120° 2½ lb. of indiarubber, and mix with it 2½ lb. of rectified turpentine of oil. When well mixed, add 1½ lb. of clear resin and 1½ lb. of yellow wax. Dissolve 3 lb. of good tallow in 7 lb. of fish oil by heating, and mix in it the above solution. Rub the mixture well in on both sides of the belt. When the belt shows a tendency to slip, apply some of the solution to the inside, or side of the belt next the pulleys, first brushing off all dust.

Adjusting Singer Repairing Machine.—Sewing machines when sold from the shop usually are adjusted to work threads up to No. 25, 3-cord wax thread, for which No. 6 special wax thread needles should be used. To use No. 18, 5-cord wax thread, the following alterations will be necessary. Fit a needle plate having a larger hole than usual, or have the needle hole in the needle plate



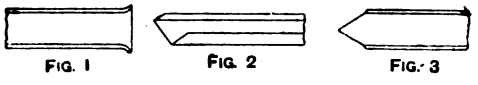
Adjusting Singer Repairing Machine.

now in use drilled larger. See Fig. 1, which shows the needle plate from the under side. Also see that the under side A of the needle plate is milled deep enough to allow the thread to pass freely over the shuttle, and make sufficient thread passage between the shuttle and the shuttle carrier by filing the heel of the carrier; see B (Fig. 2). Be sure to smooth this part with emery cloth after filing it. Use a No. 8 or No. 10 needle, according to the substance to be stitched, and if the machine has been in use a long time, remove all nitches that have been made by the finer threads in the guides, etc., or these will have a tendency to chafe the coarse thread.

Borax Photographic Toning Bath.—The borax photographic bath is found to be specially suitable for ready sensitised albumen paper, which is always in an acid condition, because the paper is floated in citric acid. Dissolve 80 gr. of borax in 10 oz. of boiling water; add 3 gr. of chloride of gold to another 10 oz. of water, and mix the two. The prints must be washed perfectly free from silver nitrate, as usual, and toning is then proceeded with in the ordinary manner. Toning is complete in from fifteen to twenty minutes, according to the temperature. The bath must be allowed to cool before using.

Rolled Gold and Filled Gold.—As a substitute for solid gold, the most common device is to make the articles of a base metal—generally brass—and electro-gild them. This process, in the case of articles subject to hard wear, such as watch cases, chains, brooches, etc., is of little use. The coating of gold is soft and thin, and very soon wears off on the most exposed parts. A better substitute for gold is made by coating brass or other hard alloy by mechanical means with a thin layer of hard gold. There are several methods of doing this. Some American watch cases, notably Waltham and Keystone, and some English cases, made by a Birmingham firm, are known as "filled gold." The result is a case made of hard brass, of which all the surfaces, outside and inside, are covered with a fairly thick plate of gold, calculated to wear almost a lifetime. The gold on these cases is so thick as to bear engraving without cutting through into the base metal, and when such cases, weighing 2 oz. or 3 oz., are sent to the refiners to be melted, they frequently produce 15s., showing the actual value of the gold covering. Rolled gold is mostly of German origin, and is made by brazing a plate of gold on a thicker plate of brass, and rolling it out thin into sheet, from which the articles are then manufactured. Rolled gold jewellery is, therefore, the same as a "gold-filled" watch case, and consists of hard brass, mechanically covered with a layer of hard gold. The gold covering may obviously be of any quality or thickness. The best is equal to American gold-filled cases. The commonest made is still greatly superior to gilt goods. The cheap jewellery seen in fancy shop windows is mostly of this kind in its commonest form, while in Germany the best rolled gold bears an official stamp—like a hall mark—guaranteeing the quality of the gold covering and its thickness. Gold casing is older than either gold filling or gold rolling, and the method has been practised in England for at least a century. It consists in covering the completed article with a thin gold shell and uniting the two by soft solder. In this case, also, the gold covering is thick and hard, can be engraved, and has a considerable value when the articles have to be consigned to the melting pot. The articles most commonly in use that are gold cased are pencil cases and pocket pens, the bows of watch cases, etc. Much old jewellery, brooches, bracelets, etc., are found to be gold cased after having been in wear the greater part of a century; their present owners often believe them to be of solid gold, and are undeceived only when the articles are taken in exchange for more modern jewellery, and have to be melted. "Rolled gold," "gold filled," and "gold cased," therefore, mean that the article so described has a hard covering of gold of an appreciable thickness, and anyone selling gilt goods under the above descriptions can be proceeded against for fraud.

Welding Channel Tyres.—The following instructions are on welding channel tyres for carriage wheels. When the ends of the tyres are hot, thin one of the ends down, using the ball of the hand hammer or a bob-punch; by this means the end will be made to spread out, as shown by Fig. 1. For the other end, cut off the ends of the webs, as shown by Fig. 2, turn the tyre on its edge, holding it on the front edge of the anvil, and taper it off as shown by Fig. 3, thinning it



Welding Channel Tyres.

down flatways at the heat. When both ends are scarfed spring the tyre so that it will hold in position whilst getting the welding heat. Now place Fig. 3 inside Fig. 1 and heat it sufficiently to hammer the scarfs together; take the welding heat, and weld up on a bottom tool which fits into the anvil, and which is made specially for the job.

Porcelain or Cast-iron Baths.—There may be a difference of opinion as to whether a porcelain bath is preferable to an enamelled cast-iron bath, yet doubtless a cast-iron bath of good quality is the better for the following reasons. An iron bath is instantly warmed by the inflowing water, because iron is a rapid conductor of heat, and in finish and general appearance an iron bath can be made immensely superior to a porcelain bath, and in all things is the cheaper of the two. An iron bath is sometimes said to cause the water to cool rapidly; but this is never noticeable when one person bathes, nor even when two children use the same water in succession.

Anti-corrosive Paints.—Medium used for anti-corrosive paints is generally made from the cheapest quick-drying varnishes that can be made; those varnishes containing a large proportion of Manilla gum or common resin are the kinds mostly employed. To prepare the medium or varnish, place 4 lb. of resin in a suitable vessel over the fire, and melt with gentle heat; then move the vessel well away from any fire or light, and allow the contents to cool somewhat; 1 gal. of coal-tar naphtha should then be added cautiously and slowly while constantly stirring, and then 1 pt. of boiled linseed oil to prevent brittleness. The preparation is now mixed, whilst warm, with red oxide which has been previously ground in this medium, or in a cheap oak varnish, and then allowed to cool down, when it may be further thinned if necessary with more naphtha, after which it is ready for use. Care should be exercised with the naphtha, as it gives off a highly inflammable vapour. This paint is extensively used for all kinds of ironwork; it dries hard with a glossy surface in about four hours, and if applied hot, in about two hours. Double boiled Baltic linseed oil, mixed with the above or with a cheap oak varnish in variable proportions, forms a very hard and elastic coating which resists atmospheric influences and sulphurous gases admirably, and which may be used on gas holders, etc., to advantage, if mixed with red-lead or oxide of iron.

Finding Radius of Arch.—Here is a brief method of finding the radius of an arch of any span by figures. Let s be the span of the arch and r the rise, then the radius R will be

$$R = \frac{s^2}{8r} + \frac{r}{2}.$$

For example, say that the span is 4 ft. and the rise 6 in., then

$$R = \frac{4^2}{8 \times \cdot 5} + \frac{\cdot 5}{2} = 4{\cdot}25 \text{ ft.}$$

radius of arch.

Milk Sieve.—Fig. 1 shows a milk sieve made of tin plate with a brass gauze bottom. Such sieves are usually in three sizes, viz. "single," "middle," and "double," and the sheets from which they are cut are respectively 14 in. by 10 in., 15 in. by 11 in., and 17 in. by 12½ in. In the pattern (Fig. 2) for the body, the radii C D and C B are equal respectively to C D and C B (Fig. 1), while the arc B A (Fig. 2) equals 3½ times A B (Fig. 1). The plan adopted by many workers of marking out Fig. 2 for any of the above-mentioned stock sizes is to treat half the length of the sheet as the radius for the larger arc, while the radius for the smaller arc is practically three-quarters that of the required size when finished. Working edges are, of course, additional, and should be allowed accordingly. Notch the pattern for a grooved seam, pass it several times through the rollers to "break" the metal, set off the working edges on B D and A E in opposite directions, bend to shape, and groove the seam on a suitable stake. Solder the seam inside, set off both the larger diameter and, in an outward direction, a creased edge to take the top rim, and set off the other edge on the smaller end, inwardly, for the gauze bottom to rest on. The top rim is next made, and it is cut so that its length is 3½ times A B (Fig. 1), plus lap for the seam, and it is equal in width to the proposed depth of rim, plus allowance for a wiring edge. This rim can be either beaten up or

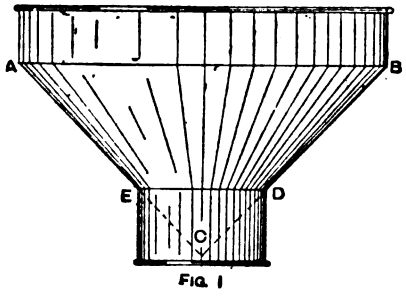


FIG. 1

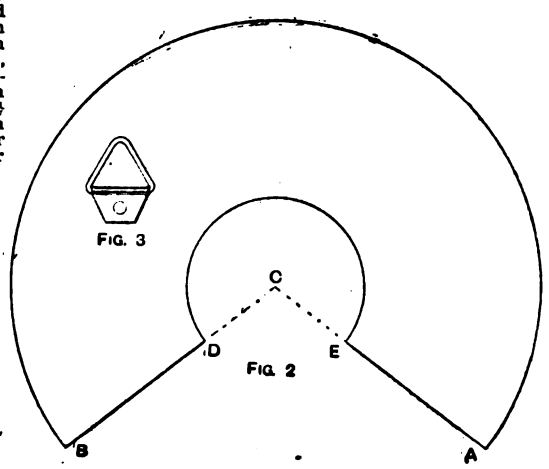


FIG. 3 FIG. 2

Milk Sieve.

simply soldered to the body; the latter method is the quicker, but the former makes a more practical job, and renders the sieve much more durable. Assuming the adoption of the "beat-up" rim, wire the strip of metal, turn it to shape, and solder the seam. Now set off outwardly a small edge so that it will tightly fit in the creased edge of the body, pane it down, beat up in the usual way, and solder it all round on the inside. The gauze bottom, which is equal in diameter to E D (Fig. 1), is cut out and soldered to the body on the outside of the edge previously mentioned. It can be obtained from a local ironmonger, and should contain at least four hundred holes to the square inch. The smaller rim is now made in a similar manner to the other rim, except that it is simply soldered to the sieve without previously beating it up. A loop (Fig. 3) of wire is plated with tin to form a hinge, and then riveted and soldered to the larger rim at the top of the seam. In conclusion, all utensils made of tin which come in contact with milk are better if resin is used as a flux for soldering.

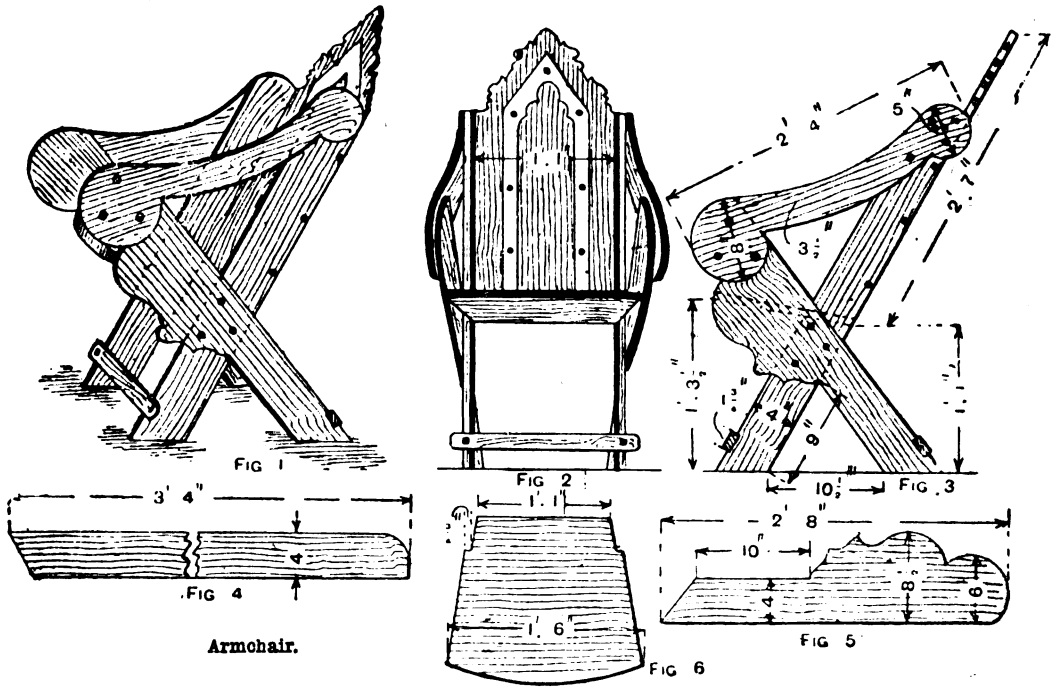
Finish of American Organs.—There is a marked difference in the finishing of American organ cases made in the United States and those made in England. American-made organs generally conform to one practice and are finished dull. The designers bear this in mind when drafting out designs, and the case makers are consequently less particular as regards the clean, level finish of the wood. Hence the dull finish does not reflect or show up all inequalities; on the contrary, if the cases are worked up bright the result is not always satisfactory. Organ cases intended for bright piano finish are less intricate in design and are cleaned up much better by cabinet makers. English made goods are generally veneered if intended for bright finish. Occasionally, however, they are worked up solid, that is, made from walnut or oak. The majority of American-made cases are built of ash or birch, which is stained in varying shades of brown. Most makers have a colour and finish peculiar to themselves; Estey's organs are reddish-brown, Clough and Warren's are dark brown, Doherty's are light brown, and Sterling's most closely give a walnut colour. Some cases, notably Bell's and Estey's, have pressed carved work panels, others have a lot of carved work planted on, and as this cannot be removed it is very difficult when working the cases up bright to leave the surface perfectly level on the flat parts immediately surrounding these carvings. In the factory the surface is built up of oil varnish, mostly stained, in a similar manner to pianos, as explained fully on p. 131. In the majority of cases this surface is afterwards dulled by pumice powder or emery; in a few instances a series of panels may be left bright. To bring up the whole of the surface to a bright finish the instrument must be taken apart, removing the fall, lock rail, knee swells, candle brackets, and all loose portions; smooth down with worn glasspaper, then apply a coat of spirit varnish; when this is dry, rub down by means of polish rubber charged with thin polish, and finish out with a little glaze in the rubber. Except on flat portions spiriting out is impracticable. To attempt to work the cases up with polish alone is not advised: the process is tedious, and constant working would disturb the under surface and eventually cause it to "check" and give a cobweb appearance. To handle American organ cases so that when finished bright they will not have a glarish, treacly appearance, much practice and tact are necessary. Instead of working them up bright by means of French polish, a pleasing finish that becomes brighter by each successive treatment is gained by constant cleaning with a mixture of equal parts of malt vinegar, linseed oil, and methylated spirit, or equal parts of linseed oil and turps may be used.

Powdering Gum Arabic.—Experiment shows that gum arabic retains a certain amount of moisture, which renders it tenacious and difficult to powder. If dried for some hours in a moderately warm oven, gum arabic will be found much easier to pulverise in the mortar. On the large scale it would be powdered in a disintegrator. As a rule, gum arabic is not powdered at all; it is readily soluble in cold water if left to steep for several hours.

Cleaning Beer Cask.—To clean the inside of a cask that has been used to contain beer, proceed as follows. Take out the head of the cask, first marking with a punch the end of a stave, and also the head opposite, so that it may be returned to the cask in exactly the same position as before. Clean the cask with cold water and a little soda and a coarse hard brush, and finish off with warm water and soda if thought desirable. If any smell remains, it may be necessary to take off the staves separately, and shave the inside of each, then replace them. The heads would also be taken out and served similarly. If any fungous growth exists, after the heads are in steam may be forced through the bunghole by means of a tube attached to a boiler; or the inside may be washed with a solution of sulphurous acid or bisulphite of lime, any excess being drained out after being allowed to lie for a time. Finish by rinsing out with water.

Using Tissue Paper as Balloon Material.—Tissue paper cannot be rendered perfectly impervious to hydrogen, but it is possible to make such paper less pervious by dipping it in melted paraffin wax, or by placing on the paper some wax and rubbing a hot iron over until the paper is well covered with the wax. As the wax renders the paper harder it may be necessary to remove some of the wax by placing a sheet of blotting paper on each side of the waxed paper, and running over it a hot iron. The tissue paper could also be treated with boiled linseed oil laid on sparingly. Balloons for hydrogen are usually made of a soft but strong and closely woven silk treated with boiled oil.

Armchair.—Fig. 1 illustrates a comfortable chair that can easily be constructed by any amateur, as there is no dovetailing, mortising, or tenoning. Fig. 2 is a front elevation and Fig. 3 a side elevation of the chair. All the stuff is ¾ in. thick, and pitch-pine will be found very lasting, though red pine will do very well. Having cut out the different pieces, put the legs (Figs. 4 and 5) together at the requisite distances apart as shown in Fig. 2. Then fasten on the arms with screws, 1½ in. long, sunk in ¼ in. so as to take a turned button-head dowel over the head. The edges of the back having been planed to the bevel taken from the plan of the seat (Fig. 6), the back itself



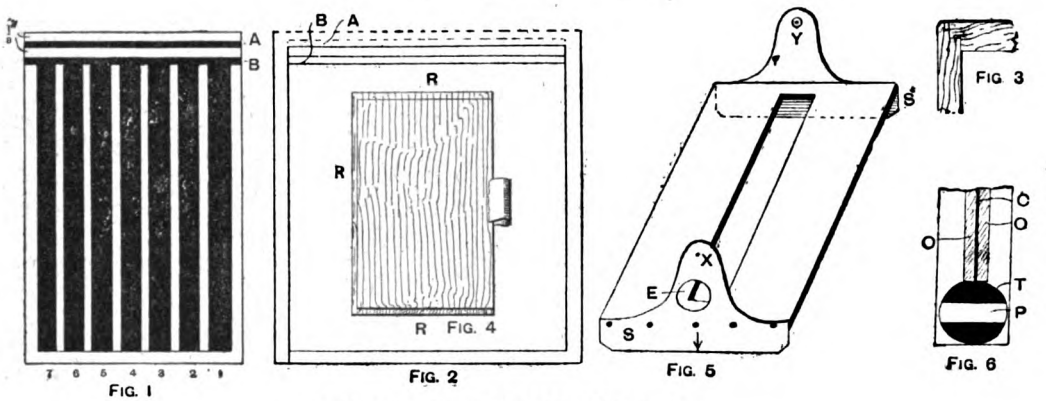
Armchair.

is next secured to the front legs with 2-in. screws. Fillets, 2 in. deep and 1 in. thick, are screwed to the legs, and act partly as clamps to them. The seat is screwed to these and to the back with 2-in. screws. A bar, 1½ in. by ¾ in., is joggled over the front and back legs to keep them rigid, and the back is ornamented with a piece of ¼-in. yellow pine cut to the pattern shown. With hair cushions for the back and seat the chair is complete.

Stand Method of Development for Photographic Snapshots.—Many amateurs, recognising that the average snapshot has a great tendency to under-exposure, may be glad to have details of a method of development which enables negatives to be saved that would otherwise be quite worthless. By its means some very fair prints from negatives exposed under most adverse circumstances have been obtained, such as, for instance, the embarkation of troops in a blinding snowstorm, or in a thick November fog. The plates were extra rapid ones, the lens aperture was *f*/11, the exposure one-ninetieth of a second, and development was complete in from half an hour to one hour. It is also a good method of developing negatives of the soot and whitewash order, such, for instance, as an instantaneous outdoor portrait on a slow plate with rather trying contrasts, for as the developer used is a weak one, there is far more control over the character of the image obtained. The dishes used are upright tanks with grooves to hold the plates, six or nine of which can be inserted at a time, and a lid is supplied which keeps out air, and also protects the plates from the fogging action of even red light. The developer found very successful is one made up according to the formula given with the Warwick plates, which for this particular method of development is diluted, when mixed for use, with its own bulk of water. The tanks should be filled right up to the brim, and the plates inserted and left for ten minutes or so, when progress can be examined. Similar tanks can be used for fixing, and much space and material is thereby saved. The negatives will be found to develop evenly and cleanly, and there is but little tendency to fog provided the developer is well diluted. In addition, good density is obtained; but should difficulty occur, it is well to have a dish of normal developer ready, into which the plate may be put for a minute or so before being fixed, or it may be subsequently intensified. Tabloids make very suitable developers for this method, and should be powdered before being mixed. Pyro (with sodium sulphite to prevent undue staining) is a favourite developer, but combined glycin or hydroquinone, and eikonogen or metol (the two latter alone have been found to give too thin negatives, while quinol is too harsh) will work very well. The fixing solution is one of sodium hyposulphite, 16 oz., to water 40 oz., or 2 pt., which preferably is distilled. To get the best results, the developer should also be mixed with distilled or boiled water.

Burning Wood Refuse.—The economic consumption of wood refuse is a problem apparently not yet satisfactorily solved. As a rule, the waste material is collected by a blow-piping system, with a fan and cyclone attachment, which delivers the material in the boiler room close to the furnace doors. Here, in conjunction with a certain proportion of coal, it is used in the ordinary way as a direct steam-raising fuel. But the conditions that are best adapted for coal combustion are not altogether satisfactory in the case of wood refuse. To burn well, a much stronger blast is needed for wood refuse than for coal; and, when the draught is increased, the light, half-consumed wood particles are discharged in a dangerous condition through the chimney. An attempt to get over this difficulty is made in Shepherd's patent wood-refuse furnace. Here in an independent hutch about 4 ft. square, and covered in at the top, the shavings, etc., are burned under conditions that prevent the escape of incompletely burned particles; while the heat and gases generated are brought away, and utilised in any manner required.

Changing Box for Photographic Plates. — Undoubtedly the best form of changing box is the bag changer. But a changing box that has seemed to give great satisfaction is described below; though it must be admitted, however, that it appears to be rather liable to cause fog. The two sides of the box are grooved in the manner shown (see Fig. 1), seven grooves ¼ in. wide running vertically, and two grooves ¼ in. wide running horizontally at the top. The back is like Fig. 2, and the front is similar except that the front will be the width of one groove higher than the back. An ordinary joint as shown in Fig. 3 will suffice for connecting up the framework, but must fit well to be light-tight. The bottom of the box is a plain board. Two sliding lids to run in grooves A and B (of the form shown in Fig. 4, that is, with rebate R) are next made and inserted in the grooves; these sliding lids should run easily. The lid A runs from the front into the top groove, and the lid B from the back into the lower groove; a rail must be fixed above B at the back in order to receive the tongue of A. These lids sliding in reverse directions can form an opening above either of the vertical grooves that carry plates. A piece will be required the full size of the top of the box covered with black velvet and fitted at the sides with thin brass plates S (Fig. 5); these plates grip the box tightly, and projections fitted at X and Y serve to grip the slide. On the side of each strip S is an arrow indicating the position for the opening by causing this to come in line with marks made on the sides of the box corresponding with the centre of each vertical groove. A special form of dark slide is required, of the solid form, which is fitted with a tap-like arrangement T (Fig. 6) in the bottom rail; when this tap is turned a free passage P is permitted into the slide. A section of this fitting is shown in Fig. 6. In filling the box, the plates O O (Fig. 6) are laid back to back with an opaque black card C between, and dropped into the six grooves (twelve plates in all). The end groove No. 1 is left vacant in order to receive (after exposure) the two plates already in the slide. The lids of the box are then re-fixed and the box is ready for use. When the two plates in the slide have been exposed, the bottom of the slide is placed between X and Y, the end of T going through E. Now by bringing the top lid over groove 1, and revolving T, the plates fall into the groove. Moving the arrow to 2 and inverting the box (of course, drawing out and in the two false lids A and B) allows a fresh pair of plates to fall into the slide; then T is again turned, A and B are closed, the top lid is pushed flush, the bolts are loosened, and the slide is removed. In the hands of a careful operator this device has given satisfaction.



Changing Box for Photographic Plates.

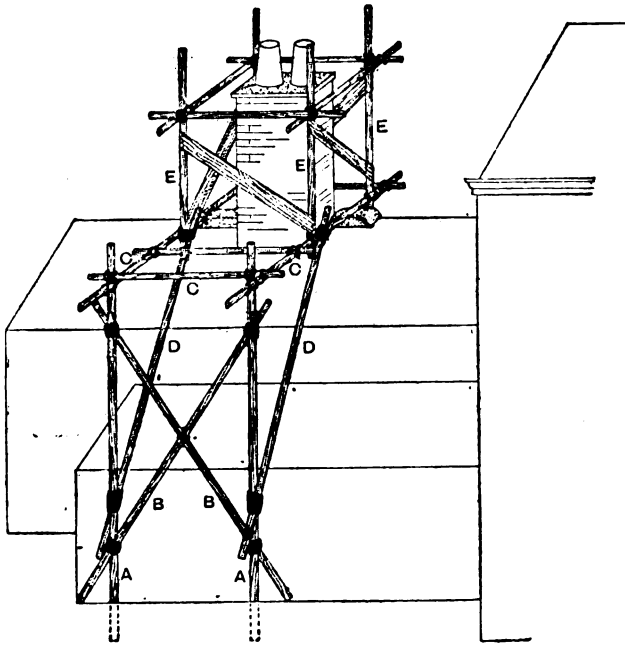
Model of Hot-water Apparatus.—A model of a hot-water apparatus for domestic supply must consist of a boiler, reservoir (cylinder or tank), cold cistern, piping, and cocks. For the boiler, procure a low glass bottle or jar, about 2½ in., with a large neck. Cork the neck soundly, and bore two holes through the cork for the pipes. For the cylinder or tank, a short lamp chimney will do, corked soundly at each end, the corks being bored for the pipes. The cold cistern need not be of glass; a zinc or tin vessel will do, with a short piece of tube soldered into it at the bottom. The pipes are of ¼-in. glass tube, which can be purchased at about a halfpenny per foot. It can be broken clean at any point by marking it round with a smooth file, and can be bent in any gas flame (a blue flame is cleanest). The joints, where two pipes come together, can be made with short pieces of elastic rubber tube of a smaller size, and stretched on. The cocks (two will suffice at first) must be very small, so as to give normal results. These can be obtained from a model maker's, or a pipe-light gas cock can be used if the nose is bent. For tees needed for the branches, glass is not available, nor is it particularly necessary. Zinc or copper tube, cut and soldered into tees, will do, and they in no way interfere with a view of the water movements. For the heat, a small spirit lamp under the boiler will do, or the heat which comes from the chimney of a small paraffin lamp serves well. Powdered amber or fine sawdust of mahogany will make the water movements visible. Either of these materials must first be put into a bottle with water, and shaken up. After the bottle has stood an hour, it will be found that some of the dust is floating and some settled, but sufficient will be found to be suspended in the water. The water, without the floating material or sediment, is then poured into the apparatus, and the heat applied. It may be added that the model must be attached to a board by wires or clips, as it is not rigid enough to stand erect without support. A square of lattice may be used and the parts wired on. This makes easy any alteration or rearrangement that may prove desirable.

Fitting Third Pivot to Watch.—Below is described how to fit a new third pivot to a watch. If the turns are used, centre the pinion for drilling with a sharp-pointed chamfering tool held in the hand. Run the pinion in the turns on this centre, and see whether it is true. If not, draw it as required. A short, strong, perfectly hard, and untempered drill is used. It is inserted in a central hole in a brass runner. The pinion is revolved by a bow, and the runner holding the drill is pressed against it with the fingers, and slightly revolved backwards and forwards. Turps is used to lubricate. The moment the drill ceases to cut, re-sharpen it, or the bottom of the hole will become burnished. If the pinion is too hard to drill, heat it to a pale blue, and remove the blue with spirit of salt, a momentary dip only, and wash well in water. Drill to a depth of at least a pivot and a half. Harden and temper a piece of steel wire, and file up in the pin-vice to a tight fit in the hole. Let it be smooth and burnished, and the hole clean. Tap it in with a hammer until it is home. Then centre in the turns, drawing the centre with a file until true. Turn the pivot on it. Smooth it with oilstone dust and oil mixed to a thin paste, and used on a flat soft steel polisher as a file, the pivot revolving and resting on a brass polishing bed, which is a brass runner suitably filed. When smooth, clean off, re-file the polisher clean, and polish with red-stuff and oil used in the same way. Round up and burnish the pivot end in a "lantern runner."

Cements used by Dentists.—The cement principally used by dentists is an oxyphosphate of zinc. The material consists of a liquid containing phosphoric acid and phosphate of zinc, and a powder consisting of oxide of zinc. When the two are mixed to a paste they set rapidly and form the oxyphosphate. Zinc oxychloride is another cement; it is formed by mixing oxide of zinc with a strong solution of chloride of zinc. Feichtinger recommends that 3 parts of zinc oxide be added to 1 part of powdered glass, and this mixed with 50 parts of a solution of zinc chloride of sp. gr. 1·5 or 1·6; then add 1 part of borax dissolved in the least possible quantity of water. Zinc oxysulphate is a similar cement formed by calcining 1 part of sulphate and mixing it with 2 or 3 parts of oxide of zinc. The mass is mixed to a paste with water previous to using.

Heating Water by Steam.—Exhaust steam is the most economical heater for water. The exhaust steam would have to be blown through a tubular heater in the tank, but in order to keep the heater in effective condition the steam must first pass through a separator which will free the steam from oil. If live steam is used, then the most economical plan, in cost and in time, is to blow the steam direct into the tank; but this blowing of steam into the tank is accompanied by an unbearable noise if the tank is situated where noise will cause a nuisance. An appliance called a silencer may be fitted to the tank; but experience has shown that to obtain silence when free steam is blowing into cool water is a difficult matter. The noiseless method of heating by live steam is to let the steam circulate through a coil, the condensed water flowing back to the boiler through a pipe run from the lowest point of the coil to below water-line in the boiler.

Scaffold for Raising Chimney.—The illustration shows a scaffold that has been erected for the purpose of raising the chimney stack of an existing building: a lean-to building abuts on the main structure, and the scaffold must be built over the



Scaffold for Raising Chimney.

two buildings. Select some good stiff poles of suitable length, dig the holes and place the two standards A in position, and afterwards well ram. But these standards should not be permanently fixed until the braces B and the ledger C have been secured (making a piece of solid work) at the proper height for the ledgers resting on the ridge. The two ledgers C should now be placed in position, one end (the butt end) hanging over the opposite side of the ridge sufficiently far to carry the puncheons E. Bags of shavings should be placed between the ledger poles and the ridge in order to prevent fracture of slates, etc. The braces D (for supporting the long ledgers) are next fixed, the short ledgers are tied to the long ones, and the puncheons E secured at the bottom to the long ledgers and at the top to the short ones. Scaffold boards for bracing are nailed to the puncheons, and boards are laid for the bricklayers. Each scaffold is reached by a ladder.

Garden Chairs made from Tea-chests.—Fig. 1 shows a garden chair made from an East India tea box, 2 ft. long and 18in. wide and deep, the only tools being saw and knife. Better legs might doubtless be made with 2-in. or 2½-in. scantling, if such should come readily to hand; but those shown are waste board from the box itself, and consist of two thicknesses nailed together between the seat and the ground. The box (lid included) will yield enough spare wood, not only for the legs, but for strengthening wherever this may be required. This chair is one which will pretty well screen the sitter from draughts; but Fig. 2 is quite an old man's chair, the sitter being sheltered from the sun and wind and from slight showers also. It may be sawn from a box 3ft. long. To make such chairs look well they should be painted, and some persons will find them more comfortable if the back legs are kept from 1 in. to 2 in. shorter than the front ones, so as to give a slight inclination to the seat and back. The original form of the boxes is indicated by the dotted lines.

Self-heating Soldering-bit.—Soldering-bits heated by benzoline or spirit may be made with a small barrel-shaped reservoir, and this, in addition to holding the

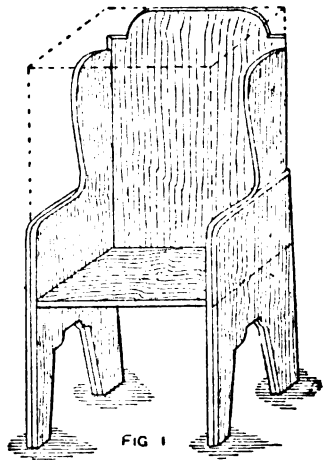


FIG 1

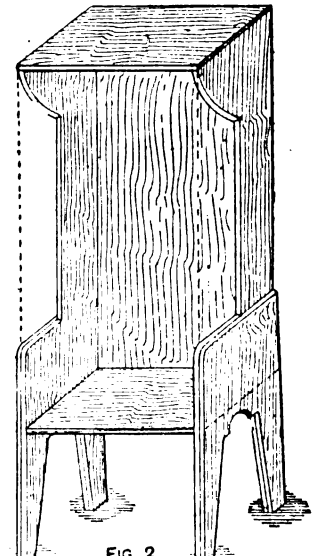


FIG 2

Garden Chairs made from Tea-chests.

spirit, is used as the soldering-iron handle. One end of the reservoir is fitted with a filling cap, and from the opposite end protrudes the tube carrying the burner. To the tube end of the reservoir an iron clip is attached, and this secures an iron bar which stands out over the burner head. At the end of this bar the copper bit is attached and held either vertically or horizontally in the flame.

Polishing Watch Jewel Holes.—By the usual method, stones for watch jewel holes are ground and polished with diamond dust on iron and copper mills or laps. The interior of a hole is polished by centreing the jewel hole in a lathe by means of shellac, and introducing a thin copper wire, into which diamond dust has been hammered. A high speed is necessary.

Making Gelatine from Ham Skins.—In making gelatine from ham skins, these should be boiled in a digester for several hours under a few pounds pressure until the material is thoroughly softened and the gelatine is practically all in the water; the solution may then be drained from the refuse, and in order to clarify it for making clear gelatine the solution should be strained through a cloth and then allowed to become cold, when the fat can be cut away from the surface. The jelly should be heated gently until just fluid, then the whites of one or two eggs should be stirred well in, and the solution heated to boiling. The white of egg coagulates and carries with it all the finely divided suspended matter, provided the temperature was not more than 100° F. when the white of egg was stirred in. The material may now be filtered through a flannel bag kept in a warm place. The solution should be run into oblong wooden moulds, and when set the jelly should be turned out by taking away the sides of the moulds. The slab of jelly may be cut with a wire into cakes of about ¼ in. to ½ in. in thickness, and these should be placed on cord nets in a clean warm room to dry. The difficulty in drying is to get the cakes hard before any germs grow on them; this can only be managed with cleanliness and as little dust as possible. When the cakes are dry, they should be wetted on the outside, brushed well with a small brush, and again dried.

Fitting Revolving Oilstone.—The illustrations show a wooden stand in which to mount a revolving oilstone which is 2½ in. in diameter and 1½ in. thick. It will first be necessary to make a spindle as Fig. 1. This may be forged from a piece of ½-in. round iron worked down to ¼ in. at A, where it passes through the stone, ⅛ in. in diameter at B for the bearings, and with a solid collar worked at C. A wooden or bone handle is fitted at one end D, and a nut is used at E to hold the stone on the spindle. The stand may be of ¾-in. hard-

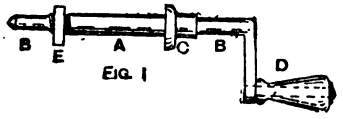


FIG. 1

Fitting Revolving Oilstone.

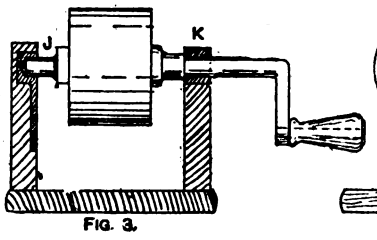


FIG. 3.

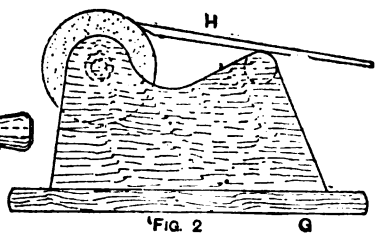


FIG. 2

wood, the two side pieces being shaped as at F (Fig. 2), and the base as G (Fig. 2). A plane iron is shown in position for sharpening at H, and for supporting the back end of this a ¼-in. diameter rod I may be dowelled between the supports. The side pieces may be glued and screwed to the base, and a couple of screw holes should be bored through the bottom for securing to the bench. Fig. 3 is a cross section through the spindle, showing the bearings, a brass socket being used at J, and a simple bearing made out of a couple of ⅛-in. brass plates secured to the side with screws at K.

Colouring Illumination Lamps.—To colour a number of white illumination lamps in different tints, the lamps should be first thoroughly cleansed from grease. For a red colour, obtain some dry crimson lake and turpentine varnish; grind up the lake to a paste with a little of the varnish, thinning it with more of the varnish to a working condition. The lamps should be coloured inside, using a flat fitch brush. In working, turn the lamps about so that the colour may evenly cover the whole surface. When thoroughly dry they are ready for use. For a yellow colour, use gamboge; for blue, use Prussian blue; and for green, mix together Prussian blue and gamboge.

Log Timber Measurement.—The recognised method of measuring log timber is to take a quarter of the girth, at the middle of the log, in feet, square it, and multiply by the length, also in feet. It is acknowledged that, unless the log is parallel and square, this rule does not give the actual bulk, but something less, and it is wisely argued that this is as it should be, in view of the waste that usually takes place when converting round or tapering logs. However, beyond knowing that certain allowance is being made, ignorance frequently prevails amongst users of this rule as to the amount of discrepancy from the actual cubic contents. This is, perhaps, due to a notion that to obtain the actual figures would require a considerable amount of skill and patience. The following is an attempt to point out as simply and as profitably as possible the fallacy of this idea. A very simple rule for discovering the actual bulk of a square tapering log is as follows (assuming, of course, the square to be perfect and the taper uniform). Multiply the width of the large end by the width of the small end; add to this the area of both ends and multiply by one-third of the length. Take, as example, a log 12 ft. long, 2 ft. square at large end, and 1 ft. square at small end.

Width of ends multiplied together 2 × 1 =	2 ft.
Area of large end 2 × 2 =	4 ft.
Area of small end 1 × 1 =	1 ft.
These added	7 ft.
Multiplied by ⅓ length	4
Actual bulk	28 cube ft.

Dealing with the same log by recognised method

Mean girth equals	6 ft.
Quarter of this 6 ÷ 4 =	1½ ft.
This squared 1½ × 1½ =	2¼ ft.
Multiplied by length ...	12 ft.
Recognised bulk	27 cube ft.

showing an allowance for taper of just 1 cub. ft. For round logs it is only necessary to remember additionally that the ratio of the circle to the square which contains it is ·7854 : 1; that is, to find the area of a circle, first find the area of the square which just contains it, and multiply by ·7854. I might point out to those readers who are not fond of decimals that the fraction ¼ will equal ·7857, so that if the area of the circumscribing square is multiplied by 11 and divided by 14, it will give an error of only 3 in 10,000. Assume a round log to be 15 ft. long, 3 ft. across the large end and 2 ft. across the small end. Find by the above method the volume of the square log which will just enclose it; then multiply by 11, and divide by 14.

Widths of ends multiplied 3 × 2 =	6 ft.,
Area of large end 3 × 3 =	9 ft.
Area of small end 2 × 2 =	4 ft.
Added	19 ft.
Multiplied by ⅓ length	5
Actual bulk of square log	95 cube ft.

11 | 14 | 1045

Actual bulk of round log ... ... 74 5/7 cube ft.

Same log by recognised method. Quarter of mean girth will be just under 2 ft.

This squared 2 × 2 =	4 ft.
Multiplied by length	15
Recognised bulk ...	60 cube ft.

Showing an allowance for roundness and taper of over 14 cub. ft. For a round parallel log, find bulk of square log which just contains it, multiply by 11 and divide by 14, as before. Take a round log 2½ ft. in diameter, and 20 ft. long.

Bulk of square log 20 × 2½ × 2½ = 125 cube ft.

11 | 14 | 1375

Bulk of round log ... ... 98 ¾ cube ft.

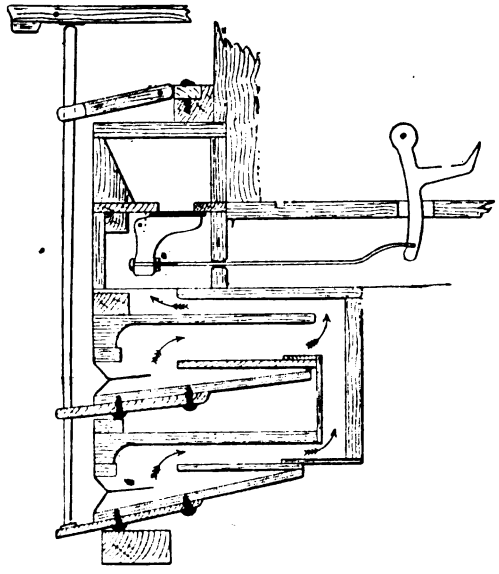
By recognised method. Quarter of mean girth will be just under 2 ft.

This squared 2 × 2 =	4 ft.
Multiplied by length	20
Recognised bulk ...	80 cube ft.

Showing an allowance for roundness of over 18 cub. ft.

Treating Raw Gutta-percha.—There are two methods of treating raw gutta-percha for removal of the impurities. The gutta may be softened in water at a temperature of about 50° C., and is then rolled out into a band by iron rollers, the top roller being loose so that any stones or hard bodies raise it and pass through. The stones, etc., are then picked out and the gutta strips folded into loose blocks, which are treated in a cylinder, and on emerging are cut into shavings by two revolving wheels. Or the gutta is placed in boiling water and then brought between two cylinders; the inner one revolves, and, being covered with sharp teeth, tears the gutta to shreds, which are carried away by water flowing between the cylinders. The shreds are softened in hot water, and the mass is kneaded in a machine in which are two or more revolving rollers covered with blunt spikes. The ordinary gutta-percha of commerce would require only to be softened in hot water and rolled into ribbon between iron rollers to fit it for the manufacture of golf balls.

Pneumatic Action of Mechanical Piano Player.—The main principle of the action of one kind of mechanical piano players is illustrated in the accompanying diagram, in which two small bellows are shown; some



Pneumatic Action of Mechanical Piano Player.

instruments have one bellows only. It will be noted that the plunger is lifted up by strips secured to the bottom of the bellows; in some cases wire connections are made instead of using round or square rod plungers. The valve is released by a wire rod; when the aperture is thereby opened the bellows close up, thus giving the necessary impact. The operating finger is shown rather short; in practice, the plunger strikes nearer the tail end.

Chinese Wood Oil.—During the last few years wood oil, also known as tree oil, oil varnish, and tung oil, has been introduced as a substitute for linseed oil, principally in the manufacture of oilcloth, varnishes, paints, and lacquers. Owing to the high price of linseed oil, many of the leading experts have investigated the properties of wood oil, the result of these observations varying considerably. Wood oil requires extreme care when used in the manufacture of oil varnishes, as it gelatinises at a temperature of 180° C., and is then useless for manufacturing purposes. Another fault in wood oil is that when used alone or with linseed oil it assumes a whitish cast, this being particularly noticeable when exposed to atmospheric influences; also in a damp atmosphere it loses its adhesion somewhat, but eventually hardens again when exposed to warm air or sunlight. To make Chinese wood oil a commercial article for varnish making requires a special treatment to prevent it peeling. The method is as follows. The oil is first heated for two hours at 170° C., and then placed aside to repose for fifty hours, when the clear top portion is ladled off; this is known as clarified oil. The clarified oil is then heated to 180° C. for about one hour or until it slightly thickens, and is then allowed to cool down to 140° C.; 2 per cent. of finely ground litharge is then added and the whole thoroughly agitated. It is then allowed to cool to about 95° C., and is thinned down with American turpentine in the usual manner. The resulting varnish dries in about six or eight hours. Resin, manilla, or dammar gums may be added to the varnish, the quantity being from 50 per cent. to 75 per cent.; this renders the varnish hard and elastic, and it dries in eight or ten hours with a hard transparent gloss. Wood-oil varnishes are more resistive to atmospheric influences when worked up with pigments; these varnishes are also useful in the preparation of enamels, especially when incorporated with zinc white. In the preparation of lacquers wood oil is also very useful, as it possesses the remarkable property of being soluble in amyl alcohol, which renders the oil valuable in the lacquer industry. Many attempts have been made to deodorise wood oil, but up to the present without success; the odoriferous principles are the result of oxidation.

Circular-saw Attachment to Sewing-machine Stand.—The illustrations suggest a method of fixing a small circular saw and spindle to a strong sewing-

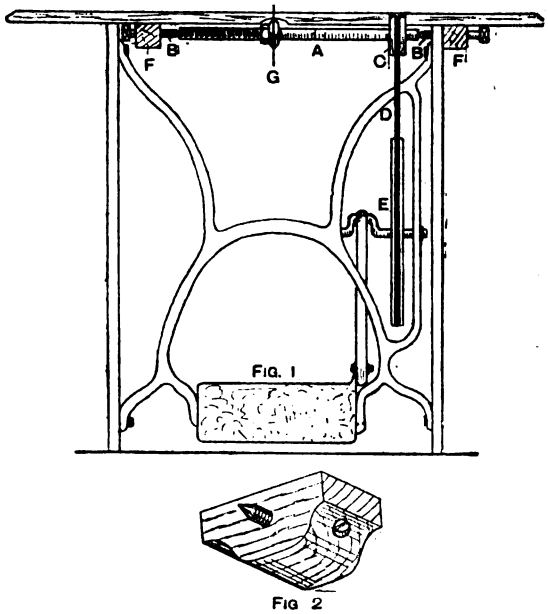


FIG 2

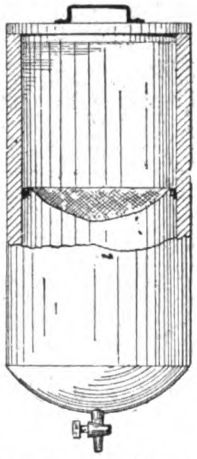
Circular-saw Attachment to Sewing-machine Stand.

machine stand, so that the saw may be driven by a treadle and wheel. Fig. 1 shows a front sectional view of the stand as fitted up with the spindle A (carrying saw, G) working on centres B and pulley C, connected by the band D to the flywheel E. The steel screws with conical points are shown turned into hardwood blocks F; these blocks are each secured to the under side of the table with two stout screws. An enlarged view of one of the blocks is shown at Fig. 2. The pulley C may be of hard wood about 3 in. in diameter.

Finding Running Feet in Square Yard of Boards.—The number of running feet to form a square yard of flooring boards, etc., is readily obtainable by the following method. Divide 108 by the width in inches of the single board, and the result is the length required in feet. Example.—What length of 5-in. floorboards is required to form a square yard? The answer is 21⅗ ft. If the boards were 7 in. in breadth, then 15⅜ ft. would be required. The general rule is arrived at as follows: Number of square inches in 1 sq. yd. is 12 × 12 × 9. The area of 1-ft. length of board having any width W is 12 × W sq. in.; hence the length of feet required is 12 × 12 × 9 ÷ 12 × W, or 12 × 9 ÷ W; that is, 108 ÷ W. No difficulty need be experienced even if the measurement of the boards be other than complete inches. Example.—How many 4½-in. boards would be required? Reduce both to halves; then 216 ÷ 9 gives the required result—namely, 24 ft.

Cleaning Windows.—Many different substances are put into the water used by window cleaners. The most powerful is hydrofluoric acid. This acid will dissolve the glass itself, and it removes grease, soot, etc., almost instantly. Much care is required in handling this acid. The best materials for ordinary purposes are dilute solutions of caustic soda or caustic potash. These may be obtained in the commercial forms from a dealer in chemicals, and may be employed in the proportion of 1 part of alkali to 20 parts of water. Another form of window cleaner may be made by slaking a little lime in water and adding to it carbonate of soda; or lastly, washing soda may be used. When using any of these substances the windows should be washed thoroughly with clean water before being dried, as they all have a tendency to act on the glass and render it dull.

Clarifying Fat.—For clarifying fats used for frying, a tall jacketed copper cylinder, through which steam can be passed, will be necessary. If the fat is merely turbid from finely divided burnt particles, it will simply be necessary to filter it; but should further purification be required, then the means for doing this would have to be considered. Fat for culinary purposes should not be treated with chemicals; all that is necessary is to add about 1 oz. of fuller's-earth for each pound of the melted fat, stir it well in, and then allow it to



Apparatus for Clarifying Fat.

subside in the jacketed cylinder; but before this is done the filtration should be tried. An efficient filter may be made from a hoop of metal fitting tightly within the cylinder, which is suitably supported and provided with a lid, and resting on three supports soldered on the cylinder at about half its height. The hoop should be loosely covered with flannel, which will hang down in the centre. The melted fat should be poured on the flannel, and will pass through it into the lower part of the cylinder, from which it may be drawn by a cock as shown in the sketch. An inlet pipe may be inserted near the top, if desired.

Substitutes for Silver-plating.—All paints and solutions made to serve as substitutes for silver-plating have a chemical action on the metal to be coated, dissolving a portion thereof and depositing an equivalent of silver in substitution. Deposition, therefore, ceases when the metal has been coated with a very slight film of silver, and such preparations are, therefore, only imperfect substitutes for silver-plating. They can only be usefully employed where a silvered appearance is desired apart from considerations of wear and tear, as in the case of articles protected by glass or lacquer. The active ingredient in silvering pastes is silver chloride; this is prepared by adding a solution of common salt to a solution of silver nitrate in distilled water until all the silver has been precipitated, then pouring off all excess solution from the white curdy silver chloride. This white paste may then be mixed with an equal bulk of bi-tartrate of potash; or with twice its bulk of powdered alum added to 8 parts each of common salt and cream of tartar; or with an equal bulk of prepared chalk added to 3 parts of pearlash and 1½ parts of common salt; or the silver chloride paste may be mixed with six times its bulk of soda hyposulphite. The wet silvering paste thus prepared must be rubbed on the previously cleaned metal with a piece of soft rag, and then polished with another piece of rag. A pad made with a bottle cork inside several folds of rag is useful when silvering broad surfaces. The double salt of silver and soda hyposulphite paste above mentioned may be dissolved in boiling water, and used in a liquid state to silver bunches of brass or copper trinkets by swilling and shaking them in the solution until they are white enough. They should then be swilled in clean hot water and dried by friction in hot bran or hot sawdust. Silvering pastes are sometimes made with salts of quicksilver or mercury in them, and these are said to be more certain in action than other pastes. But the white coat thus obtained soon turns black when exposed to air, and the mercury renders brass brittle and rotten.

Trap Nest for Fowls.—Fig. 1 shows a section of a trap nest for laying hens. The bottom of this box consists of a slope piece A at the back, to which the nest egg B is secured, and a movable piece C working on pivots D fixed at the ends to work in holes bored through the ends of the nest box. A lever E is secured at one end of C, and to the other end is attached a balance weight F to lift C to the position shown. If desired, a spring may be used instead of the weight. A cord is attached to the end of C at G, and this, after passing through a hole in the end of the box, is brought over the pulley H, and taken to another pulley over J (Fig. 2). A bell crank lever, made out of a piece of wire, is secured at K (Fig. 2) with a screw, and a short straight lever is

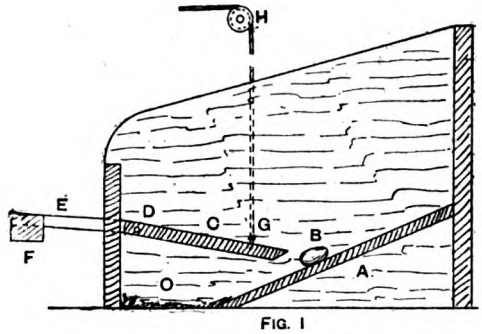


FIG. 1

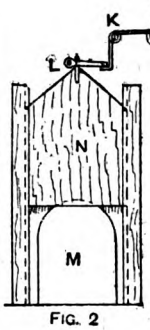


FIG. 2

Trap Nest for Fowls.

secured at L with another screw. The entrance to the nest box M is fitted with a sliding door N, which is hung on the lever L by means of a hook. When the hen enters the nest, the weight on C pulls the cord and lifts the lever at J, which releases the trigger and allows the door to drop. When the hen leaves the nest, C (Fig. 1) rises, and the egg rolls into the cavity O, where some chaff is placed to prevent the eggs breaking. This arrangement is also useful to prevent hens eating the eggs. The nest box is placed in a pen which can be entered only through the door M (Fig. 2).

Recovering Gold from Pure Gold-leaf.—It is possible to recover gold from good gold-leaf. To do this, the gold-leaf should be mixed with gum water and dried, then placed in a crucible and heated till no further smoke arises. Borax should then be added, and the crucible brought to a white heat. On breaking the crucible, the gold will be found as a button. To obtain pure gold, the silver and copper would have to be removed by solution in aqua regia, and the pure gold would be precipitated from this solution by boiling with ferrous sulphate. The finely divided gold could then be fused as above described.

Dyeing Leather Black.—Leather is dyed either by rubbing on the dyes or by immersion, but the former method will serve most purposes. Make two solutions, one by boiling 4 lb. of logwood chips with 1 gal. of water and straining; then add to this a little carbonate of soda. The other solution is made by dissolving 8 oz. of sulphate of iron (copperas) and 1 oz. of sulphate of copper in 1 gal. of water. Having both solutions warm, brush the logwood solution well into the leather, and after about a quarter of an hour follow with the iron solution; allow the leather to dry partly, and, if the black is not continuous, brush again with both solutions. Rub up a little soap with water and add a little egg yolk; put this on the leather, and rub well in. Dry the leather slowly and stretch it on a board from time to time, rubbing with a smooth piece of wood.

Piano Truck.—The framework of a piano truck should be of thoroughly dry English ash. The outer bars A (Figs. 1, 2, and 3) are 5 ft. 6 in. long by 3 in. deep and 2 in. thick, and are tenoned together with the cross-bars B (Fig. 3), which are 3 in. wide by 2 in. thick, the frame being 5 ft. long by 4 ft. wide outside. The two summers C are 2 in. square, and the centre one D is 2½ in. wide by 2 in. deep. When put together for good the tenons and mortises should have a good coat of white-lead mixed with raw linseed oil. The boards on top of the frame are 1 in. thick, and bring it level with the side pieces. The handle is 2½ in. square under the frame, and tapers slightly to the front, the

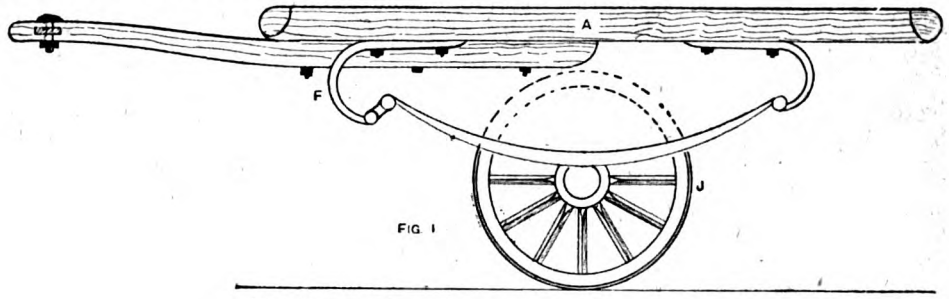


FIG. 1

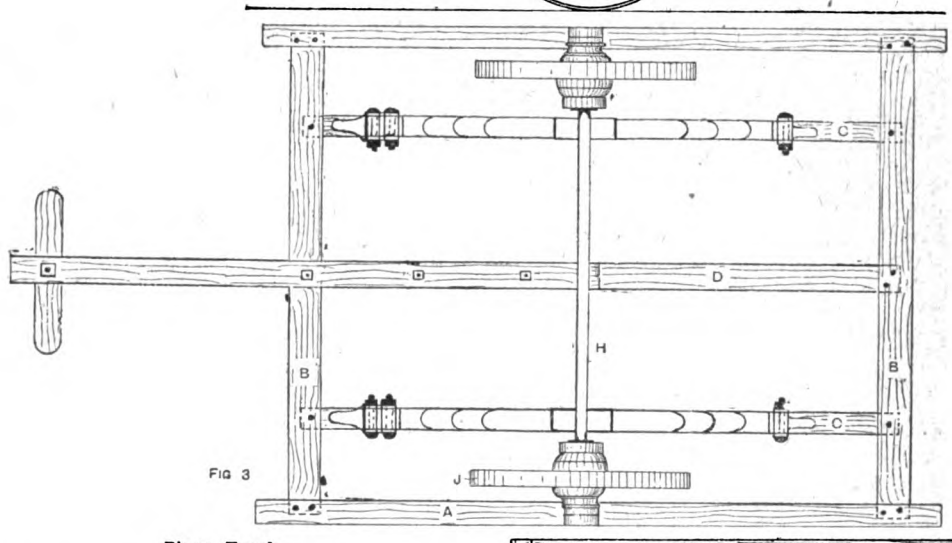


FIG. 3

Piano Truck.

cross handle being 1 ft. 4 in. long by 2 in. wide, and 1 in. thick. The front scroll irons F (Fig. 1) are 7⅛ in. deep to the centre of the bolt, the hind ones G (Figs. 1 and 2) being 6 in. deep to the centre of the bolt. The springs are 3 ft. 2 in. to the centres of the eyes, the compass over the last plate from the centre of the eyes being 6 in., the number of 2-in. steel plates five, No. 1 thick for four plates, and No. 2 for the back plate. The grease axle H (Figs. 2 and 3) is 1 in. square, with right- and left-hand threads and nuts. The wheels J (Figs. 1, 2, and 3) are 1 ft. 9½ in. high when tyred, the diameter of the stock being 5½ in., the length 7 in., with twelve 1¼-in. spokes. The height from the ground to the bottom of the framing is 2 ft.

Carriage Springs.—Here are instructions on setting and tempering springs for carriages. First it is necessary to decide what the compass in the back plate will measure when the spring is finished; from this measurement deduct ¼ in. for each plate with which the spring is made. This will give the exact compass required in the back plate before the other plates are fitted, and for a guide, mark two lines on the fitting plate at the distance required. Now make the back plate red-hot from end to end, grasp one end with the spring tongs, place the other end on the anvil, and gently press it in the middle until it assumes the depth and shape desired; this operation should be done smartly, so that the plate is still red hot when plunged into the water to cool out. When cold, re-heat the plate to temper it. To ascertain its right temper, rub along it a piece of wood till the wood flares. When letting the plates down, do not allow them to remain stationary in the fire, but move them backwards and forwards, working from the centre of the plate to one end; serve the other end in a similiar manner. When tempered, and whilst hot, hold the plate over a saddle tool or in the jaw of the vice and give it a sufficient number of blows to bring it to the right compass. Having finished the back plate, let it lie on the fitting plate edgeways; make the next plate red hot, place it in its position on the back plate, and whilst a helper is gripping the two plates together at one end smartly pinch them together with the spring tongs; then cool out in water, re-heat, and temper as before.

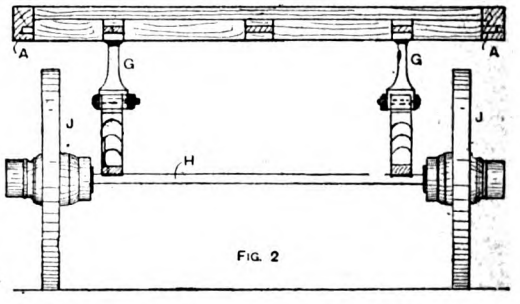


FIG. 2

Repeat the process with each succeeding plate until the spring is finished. When fitting the plates together, there should be a space between each pair of plates at the centre of the spring whilst the ends are touching.

Paste Blacking for Boots.—For paste blacking for boots, mix well together 2 lb. of ivory black, 2 lb. of treacle, and ½ lb. of sweet oil, then add ½ lb. of oil of vitriol and sufficient beer or vinegar to make 1 gallon. Another recipe: Melt 8 oz. of beeswax in an earthen pipkin and stir into it 2 oz. of ivory black, 1 oz. of Prussian blue ground in oil, 1 oz. of oil of turpentine, and ½ oz. of copal varnish. Make into balls, apply with a brush, and polish with soft rag.

Fixing Heavy Gateposts.—The drawings show a pair of framed and braced gates each 6 ft. wide by 8 ft. high, the framework being 2½ in. thick, hung to pitchpine posts 9 in. by 9 in. All the support for the posts is provided below the surface of the ground as shown at Figs. 1 and 2. A main sill or sole piece is provided and two pieces about 9 in. by 5 in., these and the main sole pieces being lapped together. The posts tenon into the main sole piece and are kept in position by braces about 5 in. by 5 in. in section. These braces would have tenons fitting into mortises in the sole piece and post, details being shown at Figs. 3 and 4. It will be seen that the posts are only braced in the two directions of principal leverage when, as in a great many cases, the gates work through an angle of 90° only; in other cases, where the gates open through an angle of 180° as indicated by the dotted position A (Fig. 1), braces B would be

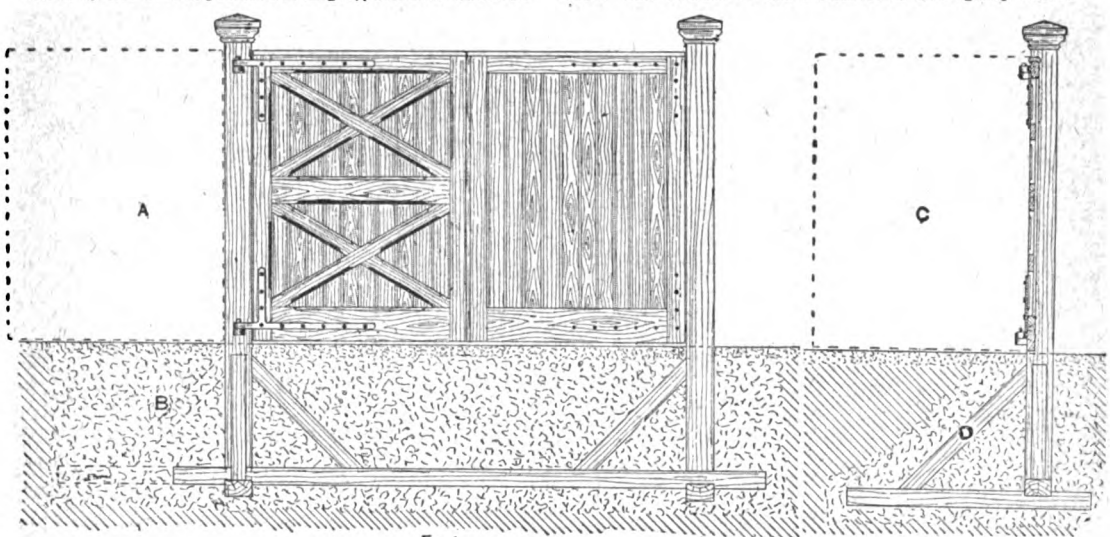


Fig. 1 Fig. 2

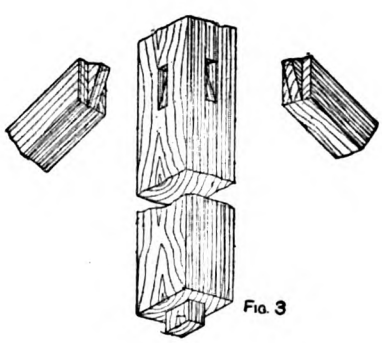


Fig. 3

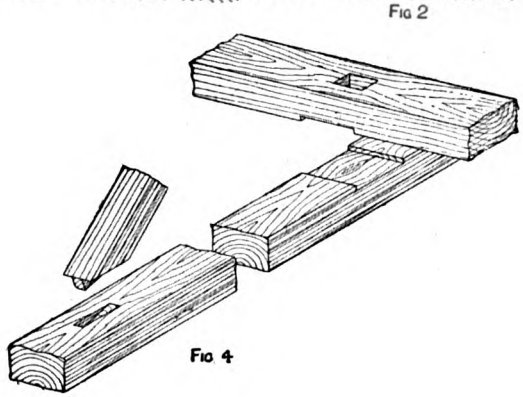


Fig. 4

Fixing Heavy Gateposts.

necessary, and the sole piece should also be longer as indicated by dotted lines. As a rule, braces would be quite unnecessary on the outside of the posts, because when the gate is open at 90°, as dotted at C (Fig. 2), the great pressure is in the direction of the brace D. The sole piece should rest on a bed of concrete about 6 in. thick, and by far the best results will be obtained by filling in the excavation made for sole pieces, etc., with concrete. It is a good plan to tar the timber work that is embedded, but if that method is adopted it is essential that the timber be thoroughly well seasoned, or it will decay all the quicker.

Lacquering Tin Green.—A green lacquer for tin may be prepared in the following manner. First dissolve 2 oz. of orange shellac in 1 pt. of methylated spirit by frequent agitation. Then add sufficient aniline green (soluble in spirit) until the desired depth of colour is obtained. Strain before using. The lacquer can be applied to the tin by means of a camel-hair brush, or the tinwork may be dipped into the lacquer. A uniform even finish is obtained by placing the tin, immediately after applying the lacquer, in an oven having a temperature of about 150° F.

Retinning Cast-iron Utensils.—The only reliable method of re-tinning old cast-iron ware is entirely to remove the old tin by filing, scouring, or machining, and then treating the article in the same way as that adopted for new goods. New cast-iron ware has the surface first prepared for tinning by being rendered smooth by one of the methods mentioned above; the article is then heated gradually to redness, and then allowed to cool. An alternative method to heating is to pickle the article for a short time in warm sulphuric acid. The article is then immersed in slightly dilute hydrochloric acid and allowed to pickle for about twenty-four hours, and is then again pickled for a short time in chloride of zinc. The article is then ready for tinning by immersion in the usual way, a pad of tow or wool, on which is sprinkled sal-ammoniac, being used to wipe out the superfluous metal. Any untinned patches can be remedied by warming the article to the melting point of tin, and rubbing a little grain tin over the untinned part with a lump of sal-ammoniac until the tin adheres; then wipe it out smooth with a pad as before.

Heat-resisting Brown Paint.—For a heat-resisting paint of a dark brown or chocolate colour, to be used on a tin-plate lamp, mix 1 lb. of drop black ground in turpentine with ½ lb. of Indian red paste paint. Thin down to working consistency with 2 parts of turpentine and 1 part of japan gold-size. This paint will dry with a dull surface, and will not be affected by the heat from the lamp.

Regulating Louvre Boards for Drying Sheds.—Figs. 1 to 4 show an opening provided with regulating louvre boards suitable for a drying shed or similar premises. Frames with splayed sills, as shown, would be made and fixed. The louvres would next be fitted to lengths, and the edges splayed and fitted together, as shown at Fig. 2. From 30° to 45° will be a suitable angle for the splayed edges. At each end they would be connected to the frame by centre pins and plates, the centre pins being fixed to the jambs of the frame, and the plates to the ends of the boards, as shown at Fig. 5. By this means each board can be placed in position. To open and close and regulate the boards, a fillet 1¼ in. by 2 in. should be prepared, and hinged to the upper inside edge of each board at one end, as indicated at A (Fig. 3). By pushing the strip up or pulling it down, the louvre boards can be opened or closed as required. To keep the fillet in position, one of the several forms of stays can be made to suit the purpose; or should the louvre boards be out of reach, an iron rod could be fixed to the fillet, or the boards could be opened and closed by means of two cords, one cord being fixed to the bottom of the fillet, and the other cord to the top. The cords are worked over a pulley, as indicated at Fig. 4.

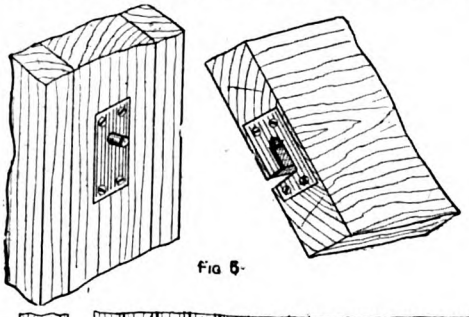


Fig. 5.

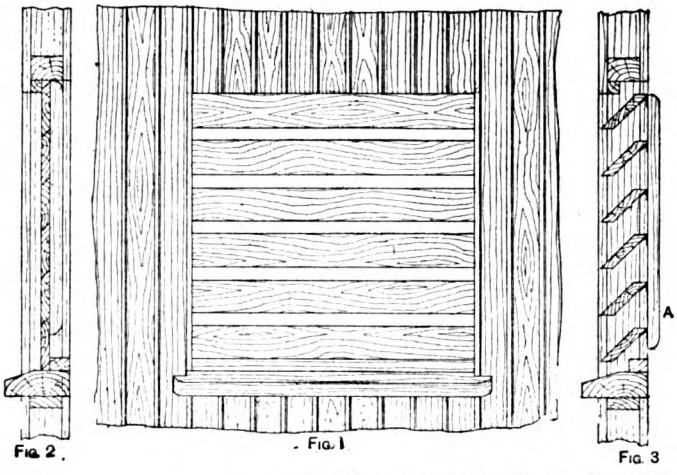


Fig. 2. Fig. 1. Fig. 3.

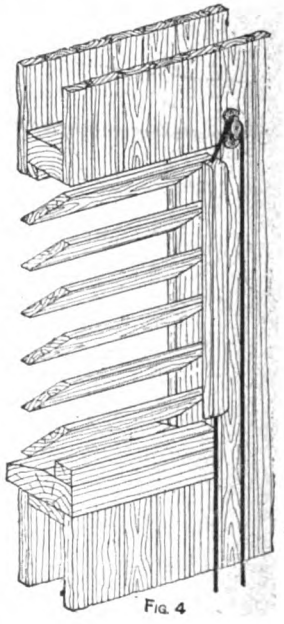


Fig. 4.

Regulating Louvre Boards for Drying Sheds.

Permanent Green Enamel.—The following formulæ for the preparation of green enamels have been found to give very satisfactory results with respect to permanency. Green enamels should be based on the zinc greens, or what are generally known in the trade as permanent or royal greens. These greens (unlike the Brunswick and chrome greens) endure exposure to light and air, and are not affected by exposure to sulphuretted hydrogen. They thus possess a decided advantage over other greens, which tend to turn black. Zinc greens may also be safely mixed with all other colours. These greens are useful for painting Venetian blinds, window sashes, and any work that is much exposed to the sun's rays. In combination with suitable varnishes, zinc greens may be converted into very durable enamels, suitable for both interior and exterior decoration. The following are practical recipes for the preparation of enamels which have been found after a long experience to be unsurpassed for permanence, hardness, and lustre. Get 5 lb. of light, middle, or deep shade zinc green, ground in varnish, and thin down to a uniform consistency with 2 pt. of crystal paper varnish, 4 pt. of pale copal or carriage varnish, 1 pt. of pale gold-size, and ½ pt. of American turpentine. This enamel will in about six hours dry hard, with a hard brilliant gloss, and is admirably suitable for interior decoration. Green enamel for exterior work should be mixed as follows: Mix together zinc green ground in best copal varnish 5 lb., with finest carriage varnish 5 pt., body varnish 1 pt., pale gold-size ½ pt., turpentine ½ pt. The varnishes employed for the outside enamels should be of the finest quality, should possess good body and durability, and should be procured from some reliable and old-established firm. The following are among the varnishes that are suitable for preparing enamels for outside use: Best copal, carriage body, dial, and (for white) colourless copal. For the interior enamels cheaper varnishes may be used, as dammar, maple, French oil varnish, crystal paper, and pale oak, which are used in variable proportions with those first named. The undercoats to receive the enamels should be prepared with a flatted spirit colour, or colour ground in turpentine, adding a small quantity of pale gold-size or raw oil to bind it, the proportions being about 1 to 4. Two coats are generally sufficient, the work being well rubbed down and dusted after each coat to give it a solid and an even foundation upon which to apply the subsequent coats of enamel, which will have an even and brilliant finish when completed. In all cases enamels should be applied in a warm temperature free from dust.

Faulty Barometer.—The wheel barometer is a syphon barometer, and if the mercury has collected at the bottom and refuses to rise, it is evident that a volume of air has entered the tube. This air must be ejected, and a true vacuum obtained in the tube above the mercury before the instrument will do its work. First remove the various parts carefully, then examine the tube. If it is sound and good, refill it with mercury clarified by dilute nitric acid. Boil the mercury and heat the tube by degrees over a spirit flame. Pour in a little of the mercury and boil it for some time. Then allow it to cool, and add a further quantity of mercury, previously warmed, This again must be boiled, and the action repeated until the tube is quite full. In this manner the moisture and air which adhere to the sides of the tube pass off with the mercurial vapour. A barometer tube is free from air and moisture if, when it is inclined, the mercury strikes against the top of the tube with a sharp metallic sound. When air or moisture is present the sound is deadened. In rearranging the weight and float over the pulley, remember that the weight is somewhat lighter than the float.

Setting Out Van Tilt.—As a help in setting out, Fig. 1 shows the side elevation of the framework of a van tilt 8 ft. long, 5 ft. wide, by 3 ft. 7 in. deep, and Fig. 2 a half-section of the tilt close-boarded on the outside. To make the tilt, two pieces of English ash A (Figs. 1 and 2), 8 ft. 4 in. long, 3 in. wide, by 2 in. deep, should be planed up square and true in line, and fixed on the van. Let in the front hoopstick B (Fig. 1), giving it a sail forward of 6 in., as shown, and keeping it in 2 in. from the front of the rave; then put in the hind hoopstick C (Figs. 1 and 2), giving it a sail backward of 1½ in. Having fixed both hoopsticks into the rave level with the outside, as shown in Fig. 2, set out an equal division at top and bottom, cramping the hoopsticks on to the edge of the rave at the same height as the front and hind hoopsticks. Fix a long straightedge on the top of the front and hind hoopsticks; it will then be easier to set the hoopsticks out true. A helper will also be necessary to tighten up the cramps used to keep the hoopsticks in place. When they are all in position, with a striking awl mark each side of the hoopsticks on the rave, numbering them as the work is proceeded with. When this is done, take off all the hoopsticks, then the raves, and let the hoopsticks in at the bench; then cut the ends on the rave, and put the hoopsticks in with a cramp on each one, as the top face of the hoopsticks must be made level on the top and round the corners to get the boards on tight and level. Now fix the hoopsticks in with a 1½-in. No. 14 screw at each side. For covering the tilt use ⅛-in. yellow pine; this ranges from 11 in. to 17 in. or 18 in. wide for ordinary work, and for special jobs the writer has had 3-in. pines, 2 ft. 4 in. wide, run out at 1 in. and ¼ in. Put on the bottom length first, then work from the centre of the roof; the corner panels must be bent to fit the corner by wetting the outside of the board, and holding it a little distance away from a hot stove-pipe, being careful not to get too much bend, or the panels will crack when being put on. For a miller's or coal van, a canvas or sailcloth covering is made, and tied on the van by eyelets let in round the bottom edge.

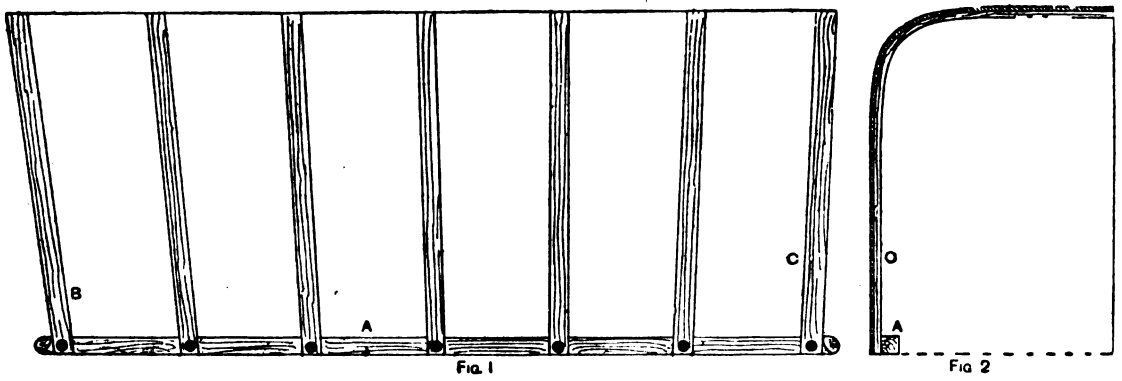


Fig. 1 Fig. 2

Setting Out Van Tilt.

Destroying Vermin by Fumigation.—First close all inlets in the room, and then place in the centre of the floor a large shallow iron or earthenware vessel containing about 4 lb. of flour sulphur mixed with ¼ lb. of cayenne pepper; set fire to this preparation and securely fasten the door. The sulphur-pepper mixture should be allowed to smoulder for about twenty-four hours. In an exceptionally bad case, the stoving should be repeated; anything, such as paper, that would prevent the sulphur fumes penetrating the corners and crevices of the walls and floors should be removed. After the stoving, wash the walls with strong carbolic acid diluted with water.

Adding Terrestrial Eyepiece to Astronomical Telescope.—Terrestrial eyepieces are made in two patterns. In one the lenses have a fixed relation to one another. This pattern is fitted to all ordinary draw telescopes for day work. In the second pattern, known as the pancratic eyepiece, the relation between the magnifying combination and the erecting combination may be altered at will; and each alteration in the relation produces an increase or decrease in the magnifying power. Terrestrial eyepieces, therefore, consist of four lenses arranged in two combinations of two lenses each. The first pair shows the inverted object, the second pair reverses it so that it reaches the eye erect. In arranging their respective positions the following provisions are necessary. (1) That the ratio of the focal lengths of the lenses in an eyepiece is usually 3 : 1, the latter representing the eyeglass; and in order that the combination should be achromatic the distance between the lenses must be equal to half the sum of their focal lengths. Thus $\frac{3+1}{2} = \frac{4}{2} = 2$ in. (2) That to find the single lens equivalent, divide twice the product of the focal lengths of the component lenses by their sum. Thus $\frac{3 \times 1 \times 2}{3+1} = \frac{6}{4}$ = 1½ in. (3) That in a refracting telescope the distance between the object-glass and the eyepiece is the sum of their focal lengths. Supposing the object-glass to have a focal length of 40 in.; then the distance between it and the eyepiece would be 40 + 1½ = 41½ in. Now in a terrestrial eyepiece the erector combination of lenses takes the place of the astronomical eyepiece, and is so arranged that the principal focus of the field lens coincides with the small inverted object formed by the object-glass at its virtual focus. Both the lenses of the erector are plano-convex, and are arranged with their plane sides towards the object-glass. The lenses of the erector combination may be secured in a tube similar to the astronomical eyepiece and in the same manner. Then a larger tube, which slides over the tube containing the erecting lenses, having been obtained and placed in position, the astronomical or magnifying eyepiece is inserted at the other end. Distinct vision is obtained by means of the sliding tube in the eyepiece, which alters the relation of the magnifying with the erecting combination, and in the ordinary manner by altering the relation of the erector lenses with the objective. A diaphragm or stop inserted between each combination of lenses will improve definition. But the great point always to be borne in mind in the arrangement and combination of lenses is to be certain that all the lenses are exactly concentric around one optical axis. The least deflection of any one of the lenses will mar the entire effect. This is why all practical opticians secure their lenses in metallic cells. Other methods are never satisfactory.

Stencil Cutting.—To cut stencil plates, the tools are an assortment of punches and chisels, a hammer and mallet, and a few smooth files. A lead piece hardened with a little zinc makes a bed for punching out the metal to the various shapes. Commence by drawing the letter required to size, and punch the metal through along the straight lines with the chisel; then, if the letter is a small one, punch round the curves with one of the small chisels until the metal is removed to form the letter. Flatten the burr down with the mallet on any smooth iron surface, and file out clean the rough edges from the cutting operation. If the letters are of large size, cut them along the straight lines as above, punch a round hole at suitable places, and as large as possible between the curved lines, and then with a pair of bent-nosed snips cut round from these holes on the curved lines of the letter. The edges are then made smooth, and the metal is flattened as described. Sheet zinc or similar material is suitable for stencils.

Hardening Copper Wire.—Copper wires and phosphor-bronze wires can be hardened only by drawing them through a draw-plate, or between straightening pins, or by some other method of compression and friction. If the wire has been made very soft by annealing, it will stretch and become smaller by the drawing process; but it is not necessary to make it much smaller to harden the wire. Impure copper will harden quicker than pure copper.

Increasing Height of Nursery Fender.—There are several excellent methods of increasing the height of a nursery fender, two of the best plans being here described and illustrated. Fig. 1 shows the end of the fender with the addition made by fixing behind the present rods round iron rods, and riveting these to the top rail, which may be either of flat iron or half-round brass. The bottom ends of each rod should be flattened out, and turned at right angles, and then screwed or riveted to the bottom plate of the fender, as shown in Fig. 2. These rods should be fastened to the main rods of the fender with wire, as shown, and also with a clip which fits over the upper rail of the existing fender, and which is fastened to the new rods with screw and nut. The upper rail of the present fender should be filed out, as shown in Fig. 3, to let in the new rods. Fig. 4 illustrates another method, a second rail of flat iron, with the round rods of the required additional height riveted into it, being fastened on to the present top rail of the fender by bolts and nuts, as shown in Fig. 5. The second is perhaps the easier method. A half-round brass top may be fixed on the upper rail of the new portion if desired, and the wirework should be made in the required length, and fastened to the round bars with wire ties.

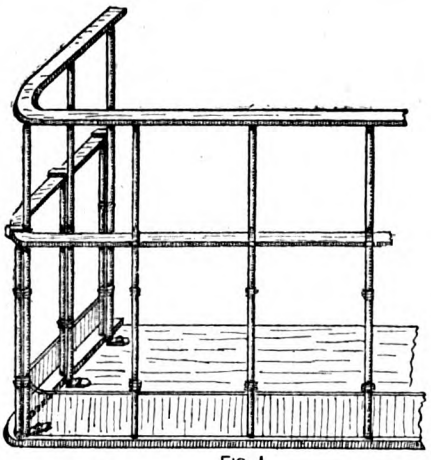


FIG. 1

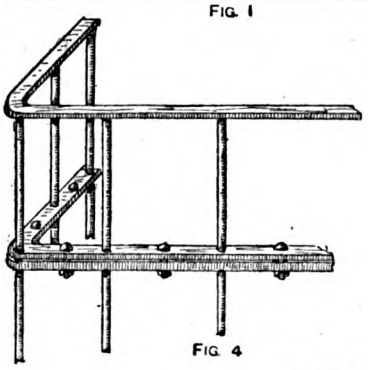


FIG. 4

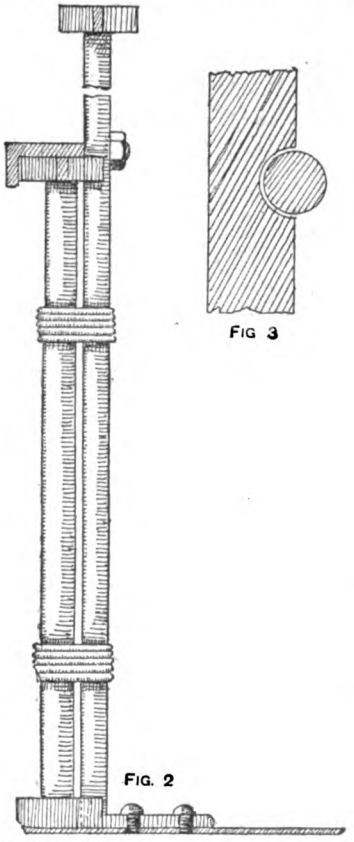


FIG. 2

FIG. 3

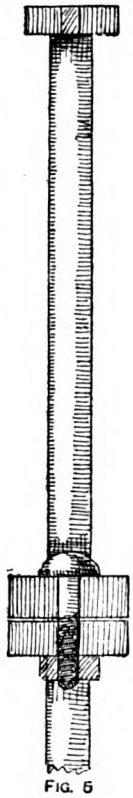


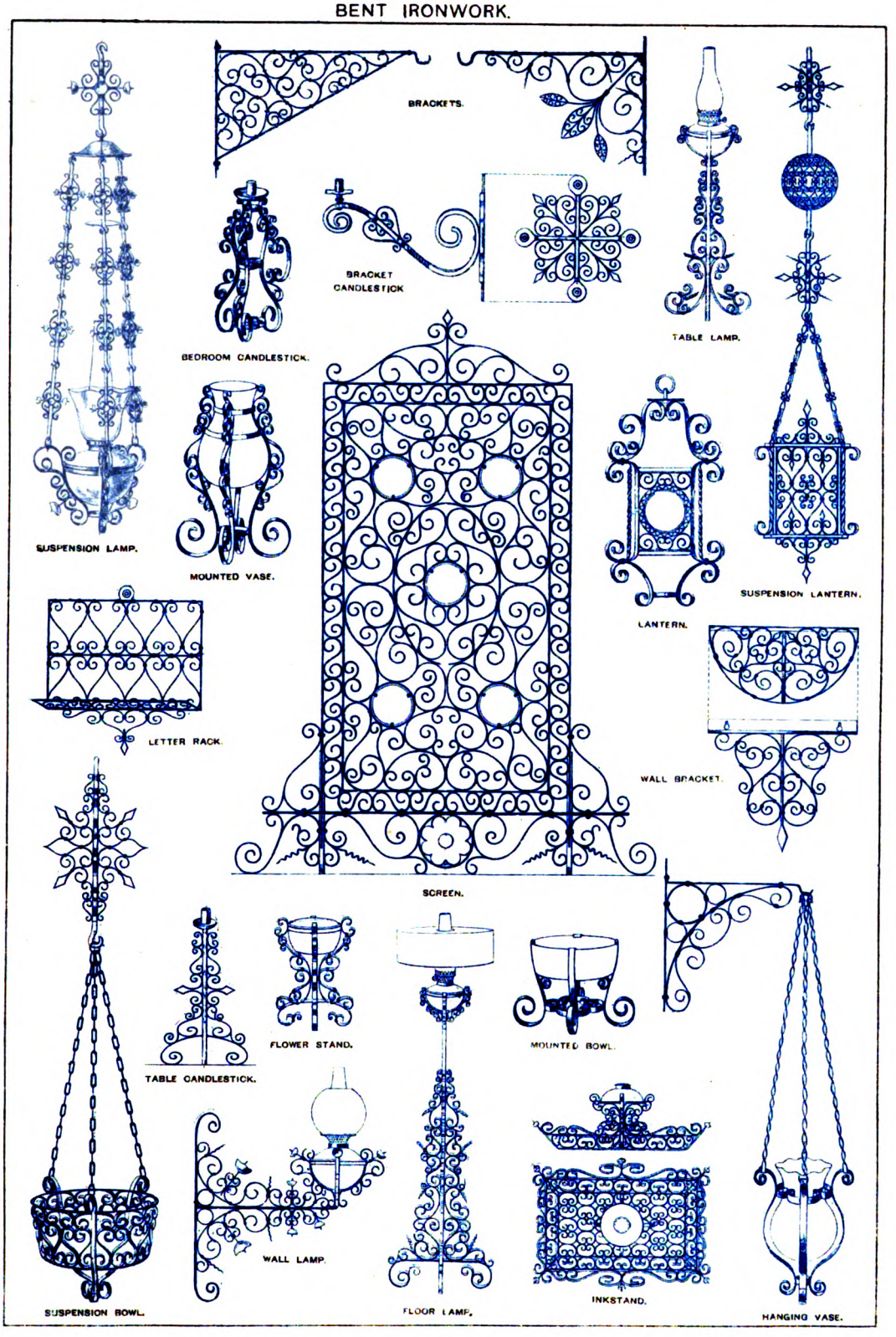
FIG. 5

Increasing Height of Nursery Fender.

Analysing Fuller's-earth.—The analysis of fuller's-earth is a long and complicated operation, requiring considerable skill. A portion is carefully weighed and the moisture determined by drying in a hot-air oven at 110° C., and again weighed; the combined water is then estimated by ignition, and, after cooling, again weighed. A portion is next weighed, boiled with concentrated sulphuric acid for several hours, and then allowed to cool. The mass is diluted with water, the silica is filtered off, washed with water until free from acid, dried, ignited in a platinum crucible, and weighed. The solution and washings from the silica are made up to a definite volume, say 500 c.c., and half of this is taken and to it is added ammonium chloride and ammonia, and the solution is boiled till it smells no longer of the ammonia. The precipitate (*a*) is filtered off and washed. It is dissolved in dilute hydrochloric acid, the solution brought into a platinum dish, and excess of pure caustic soda added. The soda must be prepared from sodium. The precipitate of oxide of iron is filtered off, washed until free from alkali, dried, ignited, and weighed. The solution from the oxide of iron is acidified with acetic acid, and the alumina precipitated by ammonia; this is also washed, dried, ignited, and weighed. The solution from the oxides of iron and alumina (*a*) is boiled, and ammonium oxalate is added; this precipitates the lime as oxalate, and it is filtered off and treated as the other precipitates. The filtrate from the lime is rendered alkaline by ammonia, and sodium phosphate added; after standing overnight all the magnesia will be precipitated. The precipitate is collected on a filter paper, washed with water containing ammonia, then dried, ignited, and weighed. The magnesium phosphate is calculated to magnesia by multiplying by $\frac{2}{11}$. The alkalies are determined in the remaining half of the original liquid; ammonia and ammonium carbonate are added in excess, the solution is filtered, then evaporated to dryness, and gently ignited; water is added to the residue, and the solution is again filtered. Pure milk of lime (free from alkalies) is now added to the filtrate, the solution is again evaporated to dryness, more water is added, and filtered, carbonic acid is passed through the filtrate, and, if any precipitate occurs, this is also filtered off. The solution now contains the whole of the alkalies (potash and soda) as carbonates. Dilute hydrochloric acid is added in slight excess, the solution is evaporated to dryness in a platinum crucible, gently ignited, and weighed. Then the chlorides (KCl and NaCl) are calculated to alkalies (K_2O and Na_2O).

Converting Cycle Wheels to Band-saw Wheels.—In converting cycle wheels to band-saw wheels, fill in the grooves of the wheels with segments of light seasoned wood. These segments should be turned off perfectly true and flat. The rims should then be covered with a band of leather or rubber. Such wheels should be used for light work only.

BENT IRONWORK.



Niello Inlaying.—Niello is an Italian name given to a peculiar kind of ornamental metal work. Niello is composed of an alloy of silver and lead, or of silver and copper, blackened by the admixture of sulphur. The process employed in working is similar to that of enamelling. The plate or other article, which should be of gold, silver, or copper, is first engraved with the design, and the alloy is laid in the incisions in grain and melted in, either with a blowpipe or in an annealing furnace. The only colours that, so far as is known, are used in connection with inlaying of metals are black (oxidised silver), white (silver), red, yellow, and green (alloys of gold). These metals are melted in the cuts, using the ordinary fluxes as for gold and silver. The proportions must be found by experiment. The work is then filed off level and polished.

Repolishing Steelwork of a Watch.—A large surface such as the cap that screws on the winding ratchet of a keyless Geneva watch is difficult to polish, and considerable practice will be required to do the work. A solid block of bell metal, flatted and stoned smooth on one side, will be necessary. This is covered with a thin paste of fine red-stuff or diamantine and oil. The piece to be polished is rubbed across and across and round and round on the polishing block. A peg inserted into the central hole serves to operate it. These surfaces are never burnished. A clean grey will look better than a bad polish, and can be gained by rubbing the steel piece on a piece of fine ground glass with oilstone dust and oil. This is a much easier process.

Portable Form.—The portable form illustrated in front and end elevation by Figs. 1 and 2 may be packed away in small space for easy conveyance as required. It will be seen that simply by lifting the seat right side up the legs and brackets fall into position and will so remain. Should it be desired, the brackets could be fastened to the legs by hooks and eyes. The form will collapse if the brackets are lifted and the legs are allowed to drop inwards. After having planed the wood to size and cut the legs to shape, a fillet A (Figs. 1 and 3) of the same thickness as the legs should be glued and screwed to the under side of the seat. The legs should be hinged to the fillets, as illustrated. Next two brackets B should be hinged to the under side of the seat near the back edge.

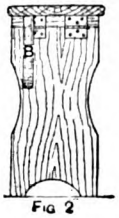


Fig. 2

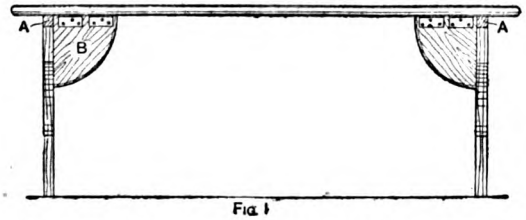


Fig. 1

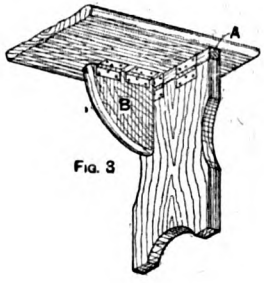


Fig. 3

Portable Form.

Quality Marks and Shipping Marks on Timber.—The following are general remarks respecting the various brands and shipping marks on timber. The difficulty of identifying parcels of timber consigned in the same freight, or stored in the same place, but belonging to different owners, was no doubt the original reason for the introduction of a marking system, and the extension of the system to marks that indicate quality was the natural sequel to the marks of ownership. There is nothing mysterious or cryptic in this system of timber marks, nor should the various marks be regarded in the light of a secret code; the great increase in the number of manufacturers and the consequent multiplication of brands are the only causes that have brought about any obscurity that may be thought to exist. There is also generally an entire want of organisation, each new manufacturer being absolutely at liberty to adopt any brand or mark that he may think fit to adopt; and though, in most cases, respect is paid to old-established marks, plenty of examples of repetition and overlapping exist. Reduced to simple terms, the system (if system it can be called) resolves itself into a parallel of the imaginary case described below. John Brown is a sawmill proprietor and forest owner in Sweden. He manufactures sawn wood goods for the English market, and in order to distinguish the goods produced at his mills from the goods of other sawmillers he stamps or stencils on the end of each piece a more or less abbreviated form of his own name; and, at the same time, uses variation in the arrangement of the lettering in order to indicate differences in quality. Thus he may export six grades or qualities of material.

The first	quality will have	J B on the end,
second	quality will have	J B N on the end,
third	quality will have	J + B + N on the end,
fourth	quality will have	J * B * N on the end,
fifth	quality will have	J — B — N on the end,
unsorted	quality will have	J N B N on the end,

or if, instead of firsts and seconds, a *mixed* grade is substituted (consisting of mixed firsts and seconds), the mark will probably be J ♛ B.

John Brown makes no secret of these marks, and would gladly inform any inquirer of the significance (as to quality) of any given brand. In fact, he is at much pains to advertise the fact that these classes of material are manufactured by him, and that the above arrangement of initials is to be taken as an indication of the comparative qualities of the stuff. The two real examples given below will show how the matter works out in practice.

(1) The Holmsunds Aktiebolag (Holmsunds Share Company) manufacture and export sawn goods and planed goods from Holmsunds, Sweden, and the following is their advertised quality code:—

SAWN GOODS.		PLANED GOODS.	
Mixed	H ♛ D	Firsts	H S ♛ N D
Thirds	H D D	Seconds ...	H S * N D
Fourths	H N D	Thirds	H L N D
Fifths	H F D	Unsorted (Sawn or Planed).	
Sixths	H M S	H S U N D	
Inferior sixths...	H S U S		

Here, obviously, the word Holmsunds has been made use of as the base for quality variations.

(2) The Fagerviks Travarw Aktiebolag, a sawmilling firm in the Sundswall district of Sweden, exports under the following marks (also, very clearly, derived from the name).

Mixed	F ♛ W
Thirds	F * W
Fourths	F ÷ W
Fifths	F = W
Sixths	F S W
Unsorted	F A W

A fact that should be noted with respect to Swedish goods is that where a mixed grade is shipped usually no separate firsts and seconds are exported, as these best qualities are not sorted from one another. In the same way as above described nearly all other firms in the Baltic and Norway trade make use of some simple method of signifying qualities, in which the initials of the head of the firm or of the company (where a company is in proprietorship) form the chief distinguishing features. Obviously, therefore, no universal key can exist that will at once make clear all details as to qualities, port of shipment, etc., except it be in the nature of a long list of names and addresses of manufacturers, and of the initials and symbols that are peculiar to the productions of each. Such a list has been constructed, and is in general use by timber merchants and all connected in any way with the timber trade. Lastly, the marking, when applied to logs, assumes several new characters that require too lengthy a treatment to be considered here. It may be said, however, briefly, that frequently group numbers, cutting numbers, private sub-owner numbers, and marks, contents marks, and even dates, are sometimes placed on the ends and sides of logs.

Bleaching Straw.—Straw may be bleached by boiling it in a solution of washing soda, washing in water, steeping in a solution of bleaching powder (chloride of lime), and then in a solution of bisulphite of soda, finally washing with water. If to be treated on a large scale, the straw, after the preliminary treatment with washing soda, should be bleached by sulphurous acid gas in a properly constructed chamber.

Making Ice.—The commonest method of freezing for ice-cream making is by a mixture of pounded ice and rock-salt; this will give a temperature of −5° F. This method is not applicable to the preparation of ice because of the large amounts of materials required to produce any appreciable effect. Mixtures of other salts with water or with ice are also sometimes used, but they are expensive, and it then becomes necessary to evaporate the solutions in order to recover the salts for use again. The heat required necessitates the use of a much greater amount of fuel than would be the case if some form of freezing machine were employed; hence, though the initial expense is greater for the latter process, it is generally employed where ice is to be made or any amount of cooling is required. A small machine to make about a ton of ice a day would cost at least £100; there are no machines made of a capacity of a few pounds of ice a day.

Heating Apparatus for Turkish Bath Cabinet.—For a Turkish bath cabinet sufficient heat can be generated either with gas or methylated spirit. Fig. 1 represents a cylindrical perforated metal lamp container, and flame guard of a methylated spirit lamp. The apparatus should preferably be made of copper, and the handle should be riveted on. The spirit lamp proper is shown at A. A simple heat radiator consists of a disc of metal to which three forked legs are riveted so that the forks will fit the top of Fig. 1. This lamp can be used for a Russian or vapour bath, but a vaporising pan as Fig. 2 will also be required. This pan is of metal plate, and rests on the top of Fig. 1 when in use; the heat radiator previously described is, of course, lifted off. B (Fig. 2) is an open-ended tube, a small chimney practically, one end of which is attached to the bottom of the pan, where a hole has been cut for the purpose. The heat

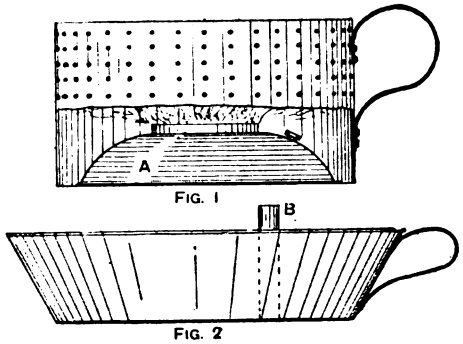


FIG. 1

FIG. 2

Heating Apparatus for Turkish Bath Cabinet.

passes through this tube, and is distributed by means of a smaller radiator, which is attached, similar to the other one. A large amount of heat is thrown off all round through the perforated flame guard. About 1 pt. of water is required, and the best spirit should be used. For heating the cabinet with gas, for the spirit lamp substitute a small concentric Bunsen burner. This can be fitted to the nearest gasfitting by a piece of copper pipe and a length of indiarubber tube. The apparatus above described can also be utilised for numerous domestic purposes.

Annealing Derrick and Crane Chains.—It is necessary that derrick chains be annealed at the termination of every large contract, or say, once in three years. Crane chains in constant use require more frequent attention, but unless the chains show signs of wear they will not require annealing more often than derrick chains. The annealing should be done by supporting the ends of three or four old rails on brick piers, and making a wood fire beneath the rails. A piece of old sheet-iron for the chain to rest on may be laid on the rails, or the chain may be laid backwards and forwards across the rails themselves. The fire should be kept up until the chain is a good red heat all through; the chain may then be drawn off with an iron hook and covered up in the wood ashes, and left to cool. The chain should, when cool, be drawn out and laid straight, then carefully examined link by link, especially at the welded ends. On any defective or doubtful link a piece of string should be tied, and any part that is much worn should be marked in the same way. A second opinion may then be obtained, and, if necessary, the bad links or the worn part of the chain may be cut out and replaced with new. The handling of the chain in this manner generally removes all scale and dirt, and leaves the chain a clean bright red. The chain should now be laid out on a wood floor, and oiled thoroughly with a brush and mineral lubricating oil, but not with linseed or boiled oil. The objects of annealing are, (1) To restore the quality of the iron and relieve it from the fatigue due to work; (2) to remove all oil and dirt so that the condition of the links may be more closely examined; (3) to permit the chain to be more thoroughly oiled before being put again into use.

Fixing Temporary Mantelboards.—The fixing of a mantelboard is a difficult job, and as it is one to which the amateur carpenter's abilities are usually first turned, the following particulars will probably be found useful. A temporary board is generally fixed because the existing one is too small. Sometimes the existing one is of wood, and in that case the method of procedure is as shown in Fig. 1. To the under side of the temporary board A pieces of wood B about 2 in. thick and 3 in. wide are screwed about 1 ft. 3 in. apart; they are ripped out, as shown, to fit over the existing board C, to which they are screwed. When the existing shelf is of iron, as in Fig. 2, it will be necessary, in order to avoid the risky and frequently unsuccessful expedient of driving nails in the wall, to get a blacksmith to make some lugs D of about ⅞-in. by ⅜-in. mild steel, well tempered. They are let in and screwed to the under side of the shelf as shown, and a fly bolt E is passed through a hole in the lug and then through the nut F. If the nut

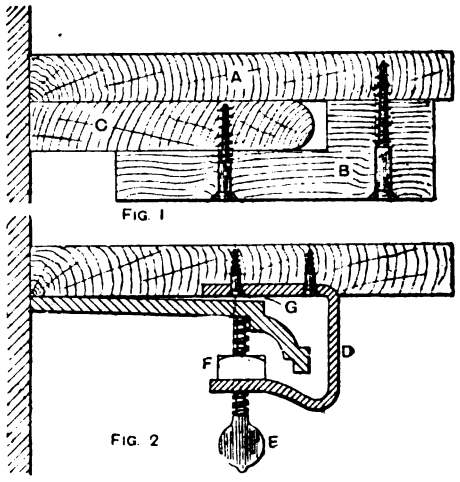


FIG. 1

FIG. 2

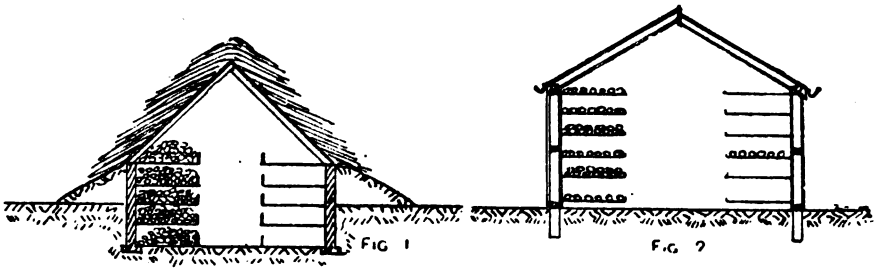
Fixing Temporary Mantelboards.

is held in the hand and the bolt screwed up, the nut will force the lugs out and sufficient pressure will be exerted to establish a firm fixing; the bolt should catch against the front of the iron shelf, as shown, and the lugs should be about 1 ft. to 1 ft. 6 in. apart. Iron shelves generally slope to the front, but the inclination is often not enough to affect articles standing on the slope, and if it is much, the upper shelf will be brought right by inserting some wedge-shaped chips of wood at G.

Welding Iron Cylinders.—To weld up iron cylinders or tubes 30 in. long, 18 in. in diameter, and No. 10 or No. 12 B.W.G. thick, an open hearth with an upright blast will be best. It is possible to weld the cylinders with an ordinary forge and blast, but with the upright blast the fire will not spread so much, and this will be an advantage owing to the thinness of the plate to be used. Great care must be taken to have a clean fire, good firing, and a continuous blast. When getting the welding heat, use a steady blast until the iron nearly reaches the welding point; then force the blast so as to bring it to the welding heat sharp. If a flux is needed, some clean sharp sand will be found all that is necessary; but it is well to try to avoid using a flux.

Boring Bagpipe Chanters.—A bell chuck on the lathe mandrel, with a deep hole in it, is essential for boring bagpipe chanters. The wood is turned to fit the chuck at one end, and driven tightly in. Sometimes a shell bit is used, and sometimes a twist drill, but in any case a long thin shank must be welded on it, and it has to be used with great care. The bit is pushed up by means of the back centre, the feeding being done very slowly, and the bit being withdrawn very frequently to clear the hole and to keep the bit from heating. The tapering of the bore is best done by hand with a tapered shell bit.

Shed for Storing Apples.—For storing common kinds of apples the form of shed shown in sectional view in Fig. 1 will be suitable. Mark out the ground for the building, 10 ft. wide, and length according to requirements. Then excavate the soil to a depth of 1 ft. 6 in. or 2 ft., according to the means of thorough drainage. Next build a wall 4½ in. thick, and 4 ft. high from the excavated level at each side, and use the surplus soil to form a solid bank at the outsides to the top of the wall as shown. Then form the roof of rafters, which may be either ordinary spars or simply rough poles, and cover the whole with a coat of thatch at least 15 in. or 18 in. thick, and coming down well over the banks at each side. The inside is then fitted up on each side with four shelves 3 ft. in width, and leaving 3 ft. for the path. These shelves may be of any rough boarding sawn to about 3 in. or 4 in. wide, placed with 1-in. spaces between them, and provided with a ledge 6 in. high in front to keep the fruit from falling off. At one end a double door should be fitted, and at the other end a double window, which should also have a shutter to exclude the light. The earthen floor should be left untouched, to ensure sufficient moisture to keep the fruit plump. The apples may be placed in layers four or five thick. In such a structure, with shelves 3 ft. wide, 1 bushel of fruit will occupy about 2 ft. length of shelf; so that a building 100 ft. long would provide accommodation for 400 bushels of apples. When placing it in the store, be sure that the fruit is dry, and free from damaged and diseased specimens, and also that it is fully ripe. For the first week or two the apples throw off considerable moisture; therefore, immediately after placing them in the store, plenty of ventilation should be allowed until the fruit ceases to perspire. After this the fruit may be kept close, a little ventilation being given occasionally. After the store has been once used and emptied, it should be thoroughly cleansed. It should then be fumigated with burning sulphur, every crevice being first closed, to destroy all insects, larvæ, etc.; and, shortly before being again used, it should be well limewashed. For best apples, or where a number of varieties for dessert use have to be stored, the building should be more commodious, so as to give more room for examination and selection of fruit. The shelves may be only 9 in. or 10 in. apart, made of laths as in the former case, and covered with a thin layer of clean straw, on which the apples should be laid not more than two deep; if room can be allowed, one layer of fruit only is preferable. Artificial heat should not be introduced, and light should be excluded as far as possible, as apples keep better and retain their freshness more perfectly in the dark than in the light. If economy is no object, a wooden building arranged as Fig. 2 may be erected, but it will be necessary to provide double doors, double walls, and double windows; and the position chosen should be as sheltered as possible, as the chief thing to avoid is a sudden change of temperature, although no anxiety need be felt if the temperature should fall two or three degrees below the freezing point during a continued frost. In such a case, if the room is kept close for some time after the thaw has set in, the temperature will gradually rise, and no harm will be done.



Shed for Storing Apples.

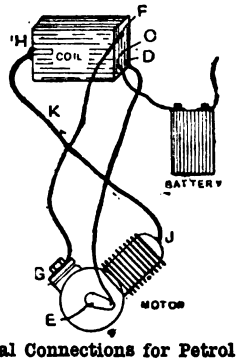
Camera Obscura.—The camera obscura or dark chamber is sometimes used by artists for the purpose of laying in the outlines of landscapes, and, as its name implies, it is a closed space impervious to light. In its simplest form it consists merely of a small circular aperture in the wall of a room from which all other light is excluded. The rays proceed from the external object and pass through the aperture, forming on the opposite wall an image of the object in its natural colours, but of reduced dimensions and inverted. By fixing a double-convex lens in the aperture and receiving the image on a white screen, the picture is made much brighter and more definite. But this method of receiving the rays is inconvenient, as the image is defined in a vertical position. Now if, for the sake of convenience, a plane mirror is placed in the path of the rays, their direction is changed and they are reflected downwards and received in a horizontal position on a table. The cheapest form of lens to use is a double-convex lens of 3 in. diameter and 8 in. focal length. But probably the best for the purpose is an ordinary photographic objective of 9-in. focus. The position of the mirror depends on the inclination of the path of the rays through the lens. If the optical axis of the lens is perfectly horizontal, then the mirror should be arranged at an angle of 45° to that axis, and the rays will be transmitted perpendicularly downwards. If, however, the optical axis is tilted from the horizontal, and if it is still required that the rays should proceed perpendicularly downwards, then the mirror must be arranged similarly, for the angles of incidence and reflection are always exactly alike, and a line drawn perpendicular to the plane of the mirror at the point of incidence will be situated midway between the two paths of rays. The distance between the objective and the reflector is fixed by the focal length of the former. Thus if the objective has a focal length of 9 in., that will be the distance between the two. The best method of arranging the lens and mirror of a camera obscura is on the conical roof of a circular chamber specially devised for the purpose. The walls of the chamber may be of corrugated iron, wood, or canvas connected at the top to a rail which runs round the entire circumference of the chamber. The roof is conical in shape, and if it is desired to obtain pictures of the surrounding country, the chamber should be fitted with wheels, which would run on the rail at the top of the circular wall. At the apex the roof is circular and has a vertical wall to which the objective and mirror are attached. The height at which these are fixed and the size of the picture received on the table stand in direct ratio to each other. For instance, if the equivalent focus of the lens is 9 in., then the distance between the points of incidence on the mirror and table should be 9 ft., and a picture disc 3 ft. in diameter will be received on the table top. There is no absolute need to erect a special chamber at any great outlay, for if the arrangement is fixed at the apex of an ordinary bell-tent the same result is obtained. It only becomes necessary to devise some method of rendering the position of lens and mirror alterable at will, and this is simplified if the lens and mirror are connected by means of a rod. This rod should have at one end a ring into which the objective could be screwed, and at the other a clasp which would receive a holder attached to the mirror. By this means the mirror and objective are retained at their correct positions, and when necessary the inclination of the mirror can be altered as desired.

Hand-made Lead Syphon Trap.—The best method of constructing a hand-made lead syphon trap with soldered seams at the sides is described below in brief. First provide a solid wood pattern of the size and form of the syphon trap that is to be made. Then cut out the two pieces of lead to the proper size, which can be found by measuring the wood block; bend one piece in position on the block and work down the sides, and then treat the other piece in a similar manner. Carefully fit together the halves thus made, and solder the seams either by wiping or drawing. North Country plumbers are very handy at such work, and frequently make such traps without any core or block. If the trap is to be made without a block, cut out the two pieces of lead to the proper sizes, plane the edges straight, and then dress the pieces of lead separately on a round wood mandril; a piece of cast-iron rainwater pipe will do for the mandril. On the bench make a full-size drawing of the trap, lay each piece of lead on the drawing in order to mark the position of the throat and the heel of each bend respectively, and open the sides of the curved pieces of lead and bend them on the drawing; then work the sides inwards and outwards (as the throat or the heel is being dealt with), carefully fit the two halves together, and solder the seams.

Ribbon of Bruges.—Ribbon of Bruges—the familiar tape which when burning gives off a strong perfume—is made as follows. In one bottle mix together 10 oz. of extract of orris root, 4 oz. of gum benzoin, and ½ oz. of gum myrrh with 1½ pt. of rectified spirit. In another bottle place ½ oz. of pod musk and 1 dr. of oil of roses. Steep unsized cotton tape or thin blotting-paper in strips in 1 oz. of saltpetre dissolved in 1 pt. of warm rose-water, and allow to dry. Then mix the two solutions, filter through a piece of muslin, and steep the ribbons in the solution; then dry them again, and they are ready. As the musk is a very expensive article, it may be left out, or replaced by infusion of musk.

Hardening Felt of Piano Hammers.—A hot iron (as used for laundry purposes) held against the tips of piano hammers will sometimes harden the felt; if this method is unsuccessful, then try dipping a piece of rag in clean water, place it over the felt, and press with the hot iron. The weak tone of an instrument may be due to the use of a cheap soft quality of felt. Or the action may not be in its proper place; it should be secured by buttons to prevent its springing away by frequent use of the foot pedals.

Electrical Connections for Petrol Motor.—The accompanying illustration shows the wiring of coil, battery, and motor, and it is as follows. From the positive terminal of the battery to the positive terminal on the coil marked C, from the terminal D on the coil to the contact breaker E on the motor, from the terminal F on



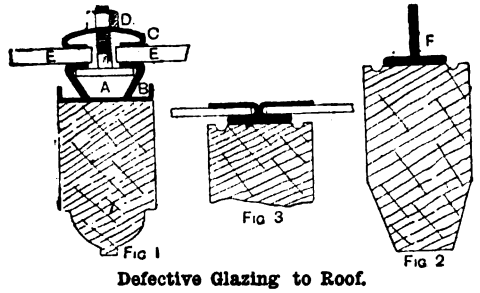
Electrical Connections for Petrol Motor.

the coil to some nut G or bolt on the motor, and from the terminal H on the coil to the sparking plug J, and from the negative terminal on the battery to the switch or interrupter. The wire K is a high tension wire.

Marqueterie Staining.—Some splendid specimens of marqueterie staining have been done with tube water colours; these, however, do not give good imitations of inlaid woods, but produce what appear to be copies of posters or glazed tiles. These pigment colours do not readily bite the surface of the wood, but are readily fixed to enable the surface to be polished by spraying or brushing over with isinglass. Use about ½ oz. dissolved in ½ pt. of water, which when cold should form a jelly. Apply with a piece of very fine Turkey sponge or camel-hair brush, working from top to bottom. Do not have the brush too wet, and avoid going over the same place twice. When the first coat is dry, apply a second coat, this time crosswise to ensure that every portion is covered. If isinglass is not at hand, clear varnish or white polish may be used, provided it is not so thick as to dry out in ridges. The colours when fixed may be polished in the usual manner adopted by French polishers, except that no grain fillers are used. The liquid wood stains sold at paint and drysalter's stores are simple in use and reliable, as they strike well home and do not readily rub off, and moreover give good imitations of the woods they are intended to represent. The stains are also sold in powder form, and are capital for outlining purposes. Brown and black are mostly used, and they must be much stronger or thicker than in the body of the design. The mixtures sold as combined stains and varnish are unsuitable for this purpose. Vegetable stains are highly commended, aniline dyes being apt to fade on long exposure to strong sunlight. The vegetable dyes are troublesome to make, and it is difficult to guarantee that a second lot of dyes, if required, will exactly correspond with those first made. Vegetable dyes generally need a fixing medium, which is included amongst the set. When no such medium is at hand, try ordinary gum if the dyes are made as water stains, or 4 oz. seed lac dissolved in 1 pt. methylated spirit for spirit stains. The process of polishing this decorated work is exactly the same whether colour pigments or stains have been employed. Polish made from bleached shellac should be used, thus ensuring it will stand out clear. The chief thing to guard against is breaking up any lines, or causing the colours to rub off and give the work a smudged appearance, and this is best accomplished by applying polish lightly at first, not having the rubbers too wet, and placing the work aside for a few minutes at a time to enable the polish to set, if not harden.

Thickening of Olive Oil.—The behaviour of olive oils varies with the temperature at which they were expressed. It may be taken, however, as a general rule, that they thicken at about 50° F. and are solid at 32° F. (the freezing point of water). Even at the freezing point they are not really solid, as on shaking or pressing much oil can be got out. Olive oil has the highest solidifying point of any vegetable oil; the other oils of a vegetable nature will stand a much lower temperature without solidifying.

Leaky Glazed Roofs.—A roof of glass resting on wooden bars in the ordinary way and puttied will sometimes be found to leak during rainy weather, although the roof may be comparatively new. Leakage through a roof frequently occurs when the bars or rafters that support the glass have been given too long a bearing, and consequently sag in the centre and break the putty joint, and also when the glass is cut too slack in the width. In the case of sagging, additional support should be given by screwing a piece of flat iron to the under side of the bars longitudinally, so as to support each bay of the roof. Of the new methods of glazing that are preferable to the old system, one is Rendle's



Defective Glazing to Roof.

Patent Invincible system (see Fig. 1); on the wood bar is fixed a zinc water channel with condensation gutters A B on each side, and on the top is a cap C, the glass E being held in position by the screw nut and bolt D. Figs. 2 and 3 show Grover's system; on the wood bar at the top edge are two hollow grooves for condensation, and on the centre part are fixed 3-lb. lead slips F (Fig. 2), the glass lying on the lead, the web being turned over on each side tight to the glass (Fig. 3).

Sharpening Pinking Machine Cutters.—Circular cutters for pinking and scalloping may be sharpened as follows, the temper first being drawn. First soften the cutter by heating it to a blood red, and allow to cool. Then place it in a vice between two pieces of brass or lead (this will prevent the vice damaging the cutter), and file to a knife edge, using a smooth half-round or three-square file, whichever is more suitable. If the cutter has small pieces broken out, it must be re-turned in a lathe before sharpening. The cutters are hardened and tempered as follows. Heat equally to a blood red, and dip in oil, then allow to cool thoroughly; next polish all over, using emery cloth on a file (be careful not to allow the emery to rub off the knife edge). When thoroughly clean, heat a piece of gas-pipe or iron of the same size as the hole in the centre of the cutter; this will temper it, or let it down as it is called. The right temper will be determined by a dark straw colour, which will proceed from the centre outwards; it may be necessary to re-heat the pipe or iron to gain the right temper, but the cutter should be slowly turned round on the pipe or iron to ensure the heat being distributed equally. When the cutter is the proper temper, dip it in cold water. Another way of tempering cutters is as follows. Bend a piece of thin sheet iron at right angles; hold this in a vice, so that it will form a table or platform. After the cutter has been hardened and cleaned as described above, put it on top of the sheet iron, place a lighted gas jet underneath, and carefully watch for the dark straw colour; then dip the cutter in cold water. It may be necessary to keep moving the cutter about to distribute the heat equally.